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AGRICULTURE, RURAL DEVELOPMENT, FOOD AND DRUG ADMINISTRATION, AND RELATED AGENCIES APPROPRIATIONS FOR 1994

NGS

BEFORE A

SUBCOMMITTEE OF THE

COMMITTEE ON APPROPRIATIONS

HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRD CONGRESS

FIRST SESSION

SUBCOMMITTEE ON AGRICULTURE, RURAL DEVELOPMENT, FOOD AND DRUG ADMINISTRATION, AND RELATED AGENCIES

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PART 2

AGRICULTURAL PROGRAMS

Printed for the use of the Committee on Appropriations

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AGRICULTURE, RURAL DEVELOPMENT, AND RELATED AGENCIES APPROPRIATIONS FOR 1994

WEDNESDAY, MARCH 10, 1993.

AGRICULTURAL RESEARCH SERVICE

WITNESSES

R. DEAN PLOWMAN, ADMINISTRATOR
ESSEX E. FINNEY, ASSOCIATE ADMINISTRATOR
EDWARD B. KNIPLING, DEPUTY ADMINISTRATOR, NATIONAL PROGRAM STAFF
DALE BUCKS, NATIONAL PROGRAM STAFF
WILLIAM TALLENT, DIRECTOR, OFFICE OF TECHNOLOGY TRANSFER
JOSEPH R. GARBARINO, BUDGET OFFICER
STEPHEN B. DEWHURST, BUDGET OFFICER, DEPARTMENT OF AGRICULTURE

OPENING REMARKS

Mr. DURBIN. We will now convene this hearing of the Appropriations Subcommittee on Agriculture and Rural Development, Food and Drug Administration, and Related Agencies.

I would like to welcome the people in the audience and the witnesses this morning. This is a very interesting aspect of the U.S. Department of Agriculture. This agency has the responsibility for trying to keep us ahead of the curve in terms of challenges, not only to the production of our food and fiber in America, but also to questions of research and technology to enhance the products that you produce for the average American family.

I might say at the outset that there are a lot of cheap shot artists in the world that like to criticize the work that is being done by the Agriculture Research Service. I recall the lady at the town meeting waving her latest issue of the National Inquirer concerned about wasting research dollars on the sex life of the fruit fly. The same lady would have gone into orbit if the price of our orange juice had gone up and she didn't realize there was a connection.

We're going to talk a little bit about Agriculture Research Service responsibilities and the challenges that they are facing. I'm happy to welcome the Administrator of the Agricultural Research Service, Dr. Dean Plowman, Dr. Plowman was kind enough to join us this morning, Dr. Essex Finney, Associate Administrator; Dr. Edward Knipling, Deputy Administrator; Joe Garbarino, Budget Officer; and Steve Dewhurst is also with us this morning.

Dr. Plowman, your entire statement will be made a part of the record. If you would like to give us at this point the highlights and summary, we will proceed.

[CLERK'S NOTE.—The Administrator's prepared statement appears on pages 103 through 122.) The Explanatory Notes appear on pages 123 through 185.]

STATEMENT OF DR. PLOWMAN

Dr. PLOWMAN. Thank you very much, Mr. Chairman. It's a pleasure to meet with you and the Committee this morning and talk about our agriculture research program. I hope that if you haven't had breakfast, this stuff in front of you doesn't distract you too much.

Mr. DURBIN. It looks a lot healthier than what I had.

Dr. PLOWMAN. We might sample some of this as we go along. I would say that the Agricultural Research Service is a problem-solving agency dedicated to sustaining the viable food and agriculture economy of this country. We want to do that in a safe manner to produce good quality food and fiber. And at the same time, we need to do things to make sure our farmers can stay competitive and be productive. So those are broad statements about our goals and missions.

Since we do have a lot of new members on the Committee, I thought this morning I might talk about what we do and some of the accomplishments that we have made and so on, and then we could get into some questions.

BENEFITS FROM AGRICULTURAL RESEARCH

One of the questions that is often asked of me is why do we need an Agricultural Research Service? Because there are a lot of people doing research around the country, we have thought about that a whole lot and I guess the short answer to that question is that there are a lot of things that are national problems that require unique facilities and a staff of highly trained people to impact those problems.

And so if we're going to work on those problems and do it in an effective way, we need a national organization that can mobilize its resources to impact those most important problems. We have some very expensive facilities, for example, that no one State or group of States could afford to have.

FACILITIES

Let me give you an example of that. Many years ago, shortly after World War II, this country was threatened with possible invasion of foreign animal diseases that could decimate our cattle herds. And so the Congress appropriated money to establish a foreign animal disease research laboratory off the coast of this country, off the tip of Long Island. It's called Plum Island.

And there we carry out a program of work to identify possible foreign animal diseases, such as foot-and-mouth disease, and African Swine Fever, and diseases that we don't have. If they came into the country, it would be a terrible problem for us. So we have been

developing diagnostic tests there and vaccines and things of that nature in case we were to have those problems.

That's an example of an expensive place to work and it's a constant problem for us to keep up with the many demands on those facilities.

I should say, too, that at the present time we are embarking on a rather extensive study to see if that kind of work might be done some other place—still in a safe manner, but maybe with less expense.

SWEET POTATO WHITEFLY

We have a core of scientists that can respond to emergencies that we might have. Let me give you a short example of that. A little more than a year ago, our country was invaded with either a new species or subspecies or a strain of the sweet potato whitefly. It's causing us a terrible problem in the states of Florida, Texas, and California and Arizona.

It's responsible right now, for example, for why we are paying a lot more money for lettuce and broccoli and some of the winter crops. It's a terrible insect. It's having an effect not only on those things, but also on cotton. The State of California and Arizona suffered severe losses last year because this insect caused the cotton to become sticky and not as productive.

So we have mobilized scientists in five or six different States to impact that problem, and I am pleased to report that we know we are making some progress. While it won't be easy to solve, it is solvable and we will be able to do that.

UTILIZATION RESEARCH

We are working on a lot of high risk things that a lot of people want worked on. I think a good example of that has to do with some of our utilization laboratories that were established some 50 years ago to find new ways of using agricultural products.

Nearly all of the work that is going on now on new uses has its genesis in those laboratories. And that agenda is becoming very important all around the country. We have great agricultural production and we need to find more and better uses for the things that we produce so well.

We carry out a program on national and broad regional issues and problems. We direct the work here at a central place and coordinate our total laboratories and scientists from around the country. We are ready to respond to issues that this Congress might have that the Secretary of Agriculture might have, or things that are very important to us.

TCK SMUT

For example, just this past week, we dispatched a scientist from our laboratory in Frederick, Maryland, over to the People's Republic of China to negotiate with the Chinese on the identification of a smut spore in a loaded ship that was embargoed in a Chinese port. We have been working with the Chinese for several years in differentiating the kind of smut spores that are produced in this country that they are concerned with becoming a problem in their country.

It has been a real problem in China accepting the wheat that we produce in our country. And so this is just an example of how we are trying to overcome those problems.

With the techniques that we have developed in identifying the TCK smut spores, our scientist was able to convince the Chinese that that doesn't prove a problem for them. And so it is really enhancing our trade, our international trade.

It is important, too, to have experts like that, because the Chinese and other foreign governments won't just accept anybody's word. So it is important that we have the technology and the kind of people that can impact those problems.

SCIENTIFIC SUPPORT

Another thing that ARS does, and is charged by the Department to do, is to be the scientific arm of the Department and support the needs of the federal regulatory agencies, like the Food Safety and Inspection Service, APHIS, the Federal Grain Inspection Service, and the Soil Conservation Service; we also do work that supports DOD, EPA, and others.

A good example of that, I think, is this problem we are having right now with the possible banning of methyl bromide in this country. The Montreal protocol listed methyl bromide as a Class I ozone depleter and that triggered the U.S. Clean Air Act to mandate that we phase out methyl bromide by the year 2000. If we phase it out by the year 2000 and we don't have alternatives to face the problems that methyl bromide addresses, it is going to cost this country a lot more money

We have a study that shows that the loss to U.S. agriculture and consumers is going to be $1.4 billion a year. So that is a very serious problem for us. For example, in Florida, we estimate that it would reduce tomato production by about 50 percent. It would almost wipe out the fresh strawberry production. So we desperately need alternatives as a soil fumigate and also as a fumigate for a quarantine treatment for a whole host of plants.

Also, we have heard a lot and read a lot about the E. coli problem that occured in the State of Washington and we are working with the Food Safety and Inspection Service on identifying that problem; how it occurred, what we can do about it, how it is carried, how we can treat carcasses and so on and so forth.

PLANT SCIENCES

Another very important part of our programs deals with plant genetic resources. ARS coordinates the National Plant Genetic Resources Program. It is a program involving both State and Federal issues. We do explorations and collections and maintain plants and insects and fungi and microbial collections that are all used to improve the crops that we grow in this country. It is an extremely important program for us.

The largest collection of seed that we have is at the National Seed Storage Laboratory in Fort Collins, Colorado. It is our germplasm bank. Just to give you an idea of how the system is used, in 1992, this national system had requests that we honored for 124,861

samples of seeds that were sent to breeders in this country and in the foreign countries to improve their crops.

Some people have asked me, well, you know, we already improved wheat. Why do we keep doing that? The simple answer is that Mother Nature has provided a host of problems that catch up with all varieties of crops. Unless we have a system that continues to improve crops, we will just fall behind.

There are always new diseases and insects and quality characteristics that need to be put into new crops and this national germplasm program provides the means in which that can happen. Between the years 1980 and 1992, we released 3480 new plant varieties in this country. These germplasm lines were used in plant improvement. That is about 285 per year. So you see, it is very necessary.

If you look at what's happened over the last 20 years, we have more than doubled the production in almost all of the major crops in the country. And it has been due, in large part, because we have had this germ plasm program that has provided the genetic diversity for this to happen and we need to protect that as much as possible.

RESEARCH BIOCONTROL

Another big research effort has to do with biological control programs for various insects and disease problems that we have. Because of the environmental concerns, everyone is looking for new ways to suppress pests, and biological control is one of those aspects. We have laboratories in the U.S. as well as foreign laboratories in France, Argentina and Korea.

Getting back to the whitefly problem, for example. When the whitefly problem came, it was obvious that after a little trial and error, we didn't have good insecticide controls for the whitefly. And so we looked for other means. Our laboratory scientists in France were called to look for biological controls.

I am pleased to report that there has been a number of collections of possible biological controls that have been collected from seven or eight foreign countries and they are in quarantine now in this country. Hopefully, they will provide a tool for us to help suppress the whitefly problem. The biocontrol tool, with the expectation of reducing possible adverse effects from pesticides that we currently use in this country, is going to be very important to us in the future.

UTILIZATION RESEARCH

We are unique, too, in having these large Federal utilization laboratories. They play a very, very important role in the food and agriculture system. It started about 50 years ago, when ARS utilization laboratories were established in four regions of the country to impact the primary crops that are grown in those areas of the country. And they have had a remarkable success story.

Let me start with some of the items we have here. For example, in the Southern Regional Research Center, since cotton is the big crop grown in the south, there was a lot of effort put into how we

can better utilize cotton. Out of that research came Perma-Prest cotton which we all use in our clothing.

The Perma-Prest cotton technology has been worth billions of dollars to this country in providing good fabric and making better and more use of the cotton that we produce. So we are pleased with that.

That laboratory has also been involved with washable woolens that we too enjoy and use. The Western Regional Research Center in Albany, California, deals with things like rice. wheat, fruits and vegetables. The frozen fruit and vegetable technology that is now worth billions of dollars in this country, came out of the technology from that laboratory.

One of the things that they have done just recently, deals with rice. When you separate rice, when you process rice, brown rice and make white rice out of it, you produce a bran product. And up until a few years ago, it was a waste product used for animal feed. Now you can buy it in Kellogg's Rice Bran.

Mr. DURBIN. I buy that all the time, but I wish you wouldn't call it a waste product.

Dr. PLOWMAN. It was a waste product. Keep eating that, it will do you good.

The Eastern Regional Research Center has done a number of good things. None of you are old enough—perhaps I shouldn't say that—to remember World War II. When I was overseas in World War II, they fed us a lot of dehydrated potatoes and they were just awful. I mean they were so bad, one day they would be brown, the next day green, and the next day you couldn't pick them up with a fork. Some of us can remember those things.

Our Eastern utilization laboratory learned how to produce potato flakes and now people would rather eat those than mashed potatoes in a lot of places. So any time you buy potato flakes, think of Philadelphia, Pennsylvania, and our utilization laboratory.

TECHNOLOGY TRANSFER

Mr. DURBIN. I hate to interrupt you, but some of the questions are appropriate, I think, at this point. Once you have developed this technology, how then does it make it into the commercial sector? What reward, if any, do we get from the private sector for our efforts? Is there a licensing agreement or anything like that?

Dr. PLOWMAN. I am glad you asked that question because it is very, very appropriate. Up until a few years ago, we didn't have a mechanism to join with industry in realizing benefits of technology transfer. Most of the things we did, when we developed things like this, would be to notify all the food processing companies.

They would come and if they thought this was good technology, why they picked it up and finished off the process and so on. The American consumer benefited certainly from the taxpayer's dollar.

Now, with the passage of the technology transfer law a few years ago, we have a mechanism now to patent things like this and issue exclusive licenses. And we are starting now to get some benefit, some revenue from those things and valuable technical feedback from the companies.

It is really important for us. There is no use doing research unless it has some use to somebody. So the big issue in the past has been get somebody to use it because that benefits all of us. But at the same time, now if we can license some things and realize benefits that we can plow back into research, we think that is good.

Mr. DURBIN. How do you choose? There have to be so many opportunities out there and you have to make a decision from the viewpoint of the Federal Government where we will put our money. You have to look at whether the private sector is already involved in it and close to finding the technology that might serve the purpose, don't you?

Dr. PLOWMAN. Yes, that is true and it is not easy to do. Our utilization laboratories and our scientists have a lot of interaction with the food processing people so they know what is going on in the field.

They look for opportunities to complement what the food processing industry is already doing or things that the food processing industry don't do, because the basic research has not gone along far enough, so they see an opportunity for commercialization.

So in working closely with them, we can identify a lot of things that might be useful. Some things have been developed that some scientist had an idea about, but might have taken 10 or 15 years before it reached commercialization. It is not an exact science in any way, shape, or form. And I am not sure I can be much more specific.

LICENSING FEES

Mr. DURBIN. When you develop licensing fees how do you put a price on those? Do you try to recoup the Federal Government's investment in the research?

Dr. PLOWMAN. I have Bill Tallent who is here. Can I have him answer your question?

Dr. TALLENT. Setting licensing fees and royalties is again a very inexact science. We usually try to get a feel for how big the market is going to be and we try to set our licenses somewhere in the range of where an industrial firm might license and charge the similar kind of fee, although we try to be a little lower because the research has been paid for by the taxpayer and we are in the business of trying to stimulate industry.

But we use as a gauge or benchmark what the similar kinds of inventions are bringing out in industry. And we have a number of ways of finding this out, including consulting firms that survey industry for us.

Mr. DURBIN. Can you give us the rationale, if a taxpayer says why should we be doing this for business? If the company that makes the potato buds is going to make a fortune off of that, why should we pay for the technology on which this company is going to make a fortune?

Dr. TALLENT. I better bounce this back to the boss.

Dr. PLOWMAN. Well, I guess you have to get back to the question of who benefits, really. It is true, the food processing company wouldn't be in the business unless they were making money. Farmers would not be producing as many potatoes today and we

wouldn't have a market for our potatoes unless companies were picking up technology and using it to expand the market, both domestic and international.

So it is a difficult question to answer; who really benefits from this research. And I guess, again, it is not an exact science.

Mr. DURBIN. I will yield to Mr. Thornton at this point.

PUBLIC PATENTS

Mr. THORNTON. Thank you very much. I was involved with the initial development of the uniform federal policy for patenting publicly-owned patents. Betsy Ancker Johnson and I drafted the first bill that came before the Congress. Dr. Jacob Rabinow, a noted inventor, testified before the subcommittee which I was then chairing.

We asked him about public patents. He had over 200. He told how a public patent was a piece of junk, that we had 20,000 wartime patents from Germany and Europe at the end of World War II, and how none of them had been developed because a patent that is free to everyone is worth nothing to anyone.

I asked him, by the way, Mr. Chairman, if he had an example of one of his inventions that he could talk about. And he said, I have a patent on a reading machine. It can read 200 pages a minute. I said, well, we could use that in Congress. He said it doesn't understand a thing it reads. I refrained from saying that it would fit right in.

But we moved forward with the first hearings and proposed the licensing of public patents because a patent is a spring to drive the implementation and dissemination of knowledge. Without it, the knowledge is available to everyone but no one has the protection needed to put it into service.

And coming out of these hearings eventually came the Stevenson–Wydler Innovation Act and the ability to enter into cooperative research. I had a little reaction from that effort, Mr. Chairman, and it was disturbing to me because, at the time that I was moving the idea of licensing public patents forward, I was engaged in a race for the Senate, and Jack Anderson wrote that while the Congress was looking the other way, Congressman Ray Thornton was slipping through a bill to give away the government rights in patents. That statement was absolutely ridiculous, completely contrary to the purpose and intent of the Uniform Patent Act.

I just wanted to join in the discussion at this point because the licensing of patents to the private sector, developing partnerships through CRADA's and others means is one of the best devices known to move inventions into the marketplace; Dr. Plowman, would you agree with that?

CRADA'S

Dr. PLOWMAN. I would agree with that, and if I might, I would just give you a couple of examples. When the Technology Transfer Act was passed, ARS became very busy in developing CRADA's with private industry. Today we have developed 295 CRADA's with private industry.

Now, I would also tell you that ARS is number one in government in the number of CRADA's. Number one in government.

Mr. DURBIN. Incidentally, this term CRADA, I am not familiar with that.

Dr. PLOWMAN. It is a Cooperative Research and Development Agreement which we make with industry. Again, ARS is number one, and that includes NASA, DOD, DOE, and everybody else. NASA put on an exhibition in Baltimore last December, and ARS received an award from NASA for being first in development of those kinds of relationships.

Now, in addition to that, they gave an award to an industry that had picked up a government patent and used it and it was the first patent, the first CRADA that ARS did. It was with a company called Embrex and the idea was, well, you can't have a poultry industry in this country unless you have a very active vaccination program for a whole lot of diseases. Now, it is hard to catch 50 million little chicks and give them the needle. So you have to have better ways to do that.

So this Embrex Company picked up ARS technology to vaccinate eggs, to vaccinate chickens in the eggs and that is going on today. And they used vaccines that we developed, too, and this was the award that NASA passed out.

Mr. DURBIN. I knew you would get his attention with chickens.

Mr. THORNTON. Yes, you certainly did. And it focuses my attention on the importance of directed research, research to solve problems. That was not basic research. You were trying to figure a way to help solve a real problem affecting productivity, weren't you, sir?

Dr. PLOWMAN. That is true.

Mr. THORNTON. And I think sometimes, in our haste for providing raw research, we neglect the advantages of directing some of that research to human needs.

Dr. PLOWMAN. Absolutely true. You know there is hardly any problem solved overnight, unless you've got a core of people dedicated to knowing what the problem is and what they are going after.

EXAMPLES OF ARS ACCOMPLISHMENTS

Mr. DURBIN. We have a number of members with questions, and I think it is very important for us to understand the role of your agency. But if you would, briefly tell us why each of these products is sitting on the table. If you could, briefly state what role ARS played in developing the products.

CORN PRODUCTS

Dr. PLOWMAN. I am glad you asked me to do that. I would rather do that than anything else.

Out in your part of the country, Mr. Chairman, corn is a big deal. We produce more corn than we can market, so we have been involved at the Peoria laboratory on finding ways to use more corn. And a few years ago, one of our scientists, with lots of imagination developed the Super Slurper. It is a corn starch derivative that has

a great ability to soak up liquids. Today, that is found in many things. I forgot what these things—diapers—looked like.

Mr. DURBIN. It has been a long time.

Dr. PLOWMAN. Tell me what that is, somebody.

Mr. DURBIN. For the record, it looks like a diaper.

Dr. PLOWMAN. You see the ads on Pampers, it soaks up better than anything else, it has Super Slurper in it.

Mr. DURBIN. A corn product, I learned something today.

Dr. PLOWMAN. It is in 100 products. If you drove to work this morning in your car you would have used it because it is in fuel filters and air filters. And so it is in everything. It is great because small industries have sprung up to produce these products now and put Super Slurper in them. I like that.

LACTOSE INTOLERANCE

Let me tell you a story about Lactaid. A lot of people can't tolerate lactose and, unfortunately, even some young people, and it is more prevalent in some races than others, and ethnic groups. So if we are going to provide milk for people to have those good products, why we need to also do something so they can digest it.

So our Philadelphia utilization laboratory developed a process to reduce the intolerance people have to lactose and now you can buy it in the stores. It is digestible or you can take it in a pill and still have milk and milk products.

ORANGE JUICE CONCENTRATE

Orange juice concentrate. How many of you had orange juice this morning?

Mr. DURBIN. I know Pete did.

Dr. PLOWMAN. Well, a number of years ago, if you wanted orange juice in the morning, you had to squeeze an orange. An ARS laboratory in Winterhaven, Florida, developed orange juice concentrate so you have it now all year round. A good product.

FLAME SEEDLESS GRAPES

Any of you had flame seedless grapes lately?

Mr. SKEEN. Yes, great product.

Dr. PLOWMAN. A few years ago, we honored the scientist and inducted him into the hall of fame for developing flame seedless grapes. Everybody that I know of likes flame seedless grapes. His name is Dr. Weinberger. He worked down in Georgia at our fruit laboratory down there and is responsible for most of the peaches that are grown in the southern part of the country, because traditional peaches need to go through a cold-warm cycle. And it has been hard to produce peaches in Florida and Georgia until he developed some that do that.

But he went to California, out to the Fresno laboratory, and he worked on grapes and plums and fruits like that. One day his wife said to him, "I am tired of eating these green grapes, why don't you develop a red table grape." And as a result of that, we have flame seedless grapes and it is one of the foremost grapes grown in the world.

Mr. DURBIN. I hope his wife is going to join him in the hall of fame.

FLAME GRAPEFRUIT

Dr. PLOWMAN. If she didn't, I'll get her there.

Here is a nice little product which came out of our Orlando laboratory. It is called flame grapefruit. We like that name. And you recognize them at the grocery stores. It is a pink grapefruit. We released this about six or seven years ago. There has already been more than 5 million trees planted in Florida to grow this variety. And it is the fastest growing grapefruit variety in the country. It is pink and has a great taste and so on. We are proud of that.

AMBERSWEET

Let me get back once again to the orange juice. I don't have an amber sweet orange here, but it is going to illustrate a point—there is a problem with growing oranges in Florida. The problem is that, if you grow a naval orange in Florida, instead of having a nice orange that you can peel and use, you get a thin-skinned thing and you can't get the peel off. So most of them go for juice.

Well, we have a scientist by the name of Jack Hern. Twenty-six years ago, he said: What do we need in oranges? He said, we need one that has got good flavor and taste. We need one that you can peel, and we want one that meets all of the market standards for color and so on.

So Jack Hern crossed a tangerine hybrid and an orange. Got a nice thick peel. Got the peeling characteristics of the tangerine and he crossed it to an orange and now we have the amber sweet orange that meets all those characteristics. We released it only years ago and there is already 4 million trees planted in Florida. It is going to be a great thing.

Now, let's go to some of these other items. Penicillin. The utilization labs got off in great shape when they were funded in 1941. We dedicated the lab in Peoria in 1941. What was going on in 1941? Well, we were having a little war.

PENICILLIN

Many years before that, there was a researcher in Britain that had identified penicillin as an antibiotic that had all of these medicinal properties but he couldn't make it. It was brought here to our Peoria, Illinois, laboratory and they learned how, by a fermentation process, to produce penicillin that saved millions of lives in World War II and ever since that time.

Now, the technology is not only used for penicillin, it is the technology that industry uses for the production of all antibiotics. A great contribution, don't you think?

In addition to Perma-Prest cotton, in the south, they are doing a lot of other things. Some of these products are in your bag. I hope as you eat this you will remember where it came from.

They have taken a synthetic yarn or a synthetic thread and they have developed a process to wrap this thread with cotton, wrap it and make a yarn out of it. And it makes a beautiful cloth that has all the qualities of cotton and yet has Perma-Prest characteristics

and wearability like some of the synthetic fabrics. You are going to see this product in everything. They have developed also a new process called——

POLYTHERM

Dr. TALLENT. Polytherm.

Dr. PLOWMAN. Yes, Polytherm. It is a new process that is used in making winter clothes. So that is a great product too.

The sugar business. ARS is the only group in the country that has a breeding program on sugar. This is beet sugar conducted in four or five places at ARS, and we have a couple of laboratories that work on cane. That is in your bag too.

LUPINE PASTA

We have some pasta product made out of a new crop. Years ago, people used to grow lupine in this country and lupine went out of business. It couldn't compete. But lupine will make some really good pasta that doesn't stick. Even I can cook it and it won't stick together. And it has lots of good characteristics. It is a crop that can be grown as far north as Maine and they desperately need a new crop to rotate with their potatoes.

Mr. DURBIN. Ms. DeLauro will test that for us.

SOLDIER BUGS

Dr. PLOWMAN. We do a lot of bug suppression work in the country, and the main thing has been to get rid of bugs; right? Well, we have one thing here which says "Soldier Bugs to the Rescue." I think this is manufactured by a company up in Washington.

This is called Soldier Bugs to the Rescue. It is an attractant for beneficial insects. You put that out in your flower garden and you won't need to spray anymore because it will attract good insects to come and beat up on your bad insects.

INSECT REPELLANTS

Have any of you been bit lately by insects? ARS has a program in conjunction with DOD to develop insect repellants which are used in the military and now by a lot of industries. It is called DEET and it has been used for a long time. The latest formulation was used in the Gulf War because of the many problems they had over there with insects. So you can buy that on the market.

SOYBEAN OIL

Some other things that you will find in the grocery store are salad dressings with soybean oil in them. Years ago, soybean oil had a lot of bad properties in it. Today, because of a lot of the research that was done again at the Peoria laboratory, we find soybean oil in all kinds of salad dressings and low cal and whatever.

Here are some snack items. Another technology which came out of the laboratory in Philadelphia. It is a meat and cheese product. Now, one of the things that the American consumer absolutely demands, and we support that of course, is that anything you buy has to be safe to eat. And it is hard to package meat and things like

this without having microorganisms in it that will either spoil it or cause a problem with digestion.

They have worked on this problem and you can find these snack food items all over and the secret is getting the right kind of moisture content in it so it will preserve and eliminate those problems.

HARDY POTATOES

Here is a nice little product. I think this is in your bag too. It is a new variety of potato. There are a lot of potatoes grown in the northeast and a problem developed a few years ago with nematodes. The golden nematode is only in certain parts of the country. And it really threatened the eastern seaboard growing areas.

So we went to work to develop a variety that would be resistant to the nematode, and while we were at it, we wanted to improve the product. So what we have now is a new variety that resists nematode infections and in addition to that, is a good potato for chips.

Traditionally, industry makes chips from fresh potatoes, ones that have just been taken out of the ground. You can't store them for six months. But you can with this variety. So, again, it is going to expand the use of potatoes.

MUSCADINE GRAPES

Anybody remember muscadine wine? You know the muscadine business went out of business. But now it has had a resurgence. It is not wine anymore, but because of some of the work that we have done in the propagation, muscadine grapes is a native product in the country and grows down in your part of the country.

And so what we have done is develop some new varieties of muscadine and packaged it in natural juices. That is in your bag too.

FOOD IRRADIATION

Here are some strawberries. Do those look all right? They look all right. I was going to tell you that they were picked about three or four weeks ago. And the reason they look like this is because they have been irradiated. Now irradiation of fruits and vegetables is a controversial issue. The technology has been worked out in our Philadelphia laboratory.

We have one commercial irradiator now in Florida and it will extend the shelf life of things like strawberries for two or three weeks or much longer than we have now. We are going to see a lot more of these as soon as we get over the apprehension concerning irradiation of food. It is a technology that can be used to take care of the E. coli problem with meat. This is a technology worked out up in our Philadelphia laboratory.

PUFF DRYING

Philadelphia has also been researching other things. While they were making dry potatoes, that developed a puff drying process that is used for all kinds of products. Here is a little example of that. These are cranberry muffins.

It is very hard to dry cranberries. If you do—what you usually end up with is a hard clump and you put them in baked goods. It is

not too good. They developed a process called puffed-drying that makes it porous and it will reconstitute rapidly and you can put it in all kinds of products. It has been used on all kinds of fruits and berries.

PECAN RESEARCH

The pecan industry suffered a problem a few years ago. Two new diseases invaded our pecan industry. I don't know how many of you can remember what pecans cost two years ago, but it was terrible, because the crop was cut in about a third. We have a pecan research laboratory down in Byron, Georgia, that jumped on that problem.

We have now identified two new diseases and found some ways to control them. And so pecans aren't going to cost as much. These have been enhanced a little. They have a sugar coating on them. I like them both ways, but you will like these.

FRUIT RESEARCH

This is new technology that we patented and a major company picked up on. A lot of people don't like to peel oranges or grapefruit and they have developed a process, an enzyme process that peels it for you. It takes all of the white membrane out of it. Sunkist is marketing this size snack packs. It is a really great, great product. It looks better than the way I peel them.

There is a research story, you know, behind everything that we pick up. We go to the grocery store and you don't think about it.

Here is an apple produced up in Kearneysville, West Virginia, our fruit station up there. But what is unique about it? Well, it is a nice big apple with no blemishes or bruises and so on. It was picked with a machine, a mechanical harvester. So a couple of technologies had to be developed for that.

You had to develop some trees and train these trees so that the machine could get to them. So it took some production characteristics. It took some engineering to develop a machine that would pick them. While we were at it, we developed some low insecticide application methods to reduce the ag chemicals in it, and when we got through, we ran them over a scanner to sort out the ones that have bruises on them.

So you can buy these now in the grocery stores. At one of the laboratories out in Washington State, we learned how, under atmospheric storage, we can store apples. In fact, one of the problems that the industry is having now determining a year-old apple from the one that was just picked because of the storage conditions that we have developed.

There is a story behind everything that you buy. It took a lot of technology.

RESEARCH BENEFITS

So really the big question is: Who benefits from all this? Certainly farmers benefit. If we didn't do these kinds of things, the farmer couldn't stay competitive. He couldn't stay competitive in production. If the price a farmer receives for his food doesn't keep up at

least with inflation, then he has either got to be more efficient or he must get out of business.

That is why this country has fewer and bigger farms all the time, because the price the farmer receives for his crops has not kept up. He has to get more efficient all the time. And he has not done that by chance. He has done that because we have had a very, very aggressive Federal and State research program. So too, we have been able to keep the price of food low.

We are so lucky in this country. We have just a couple of percent of our people producing all the food. We are only spending about 11 or 12 percent of our disposable income on food. We take it all for granted. But there is a research story behind this success.

PLUM ISLAND

Mr. DURBIN. We have a number of members here and a lot of questions and your commitment and enthusiasm is very important. I thank you for that. I thank you for this presentation. I think it will help each of us as we run into questions, about the value of research, from the people in America.

I would like to ask one specific question concerning the situation in Plum Island. There was an article in the New York Times at the end of December which raised questions about this facility. As I understand it, this facility has been part of the ARS for 40 or 50 years and is an island off of Long Island, New York, which is used for researching infectious diseases of animals.

I assume the original rationale behind Plum Island was to quarantine infectious disease. Is that reason outdated? Do we still need that type of physically separate facility for dealing with infectious disease related to animals?

Mr. PLOWMAN. You really have two problems with that and we are now embarked in a partnership with APHIS and the industry to look at that very issue.

There has been a lot of good technology developed in the last 40 years. It is questionable in our mind whether we need to have the kind of safeguards that we have at Plum Island. That was established by legislation because our industry was very scared. If we were going to investigate foot-and-mouth disease, we wanted to make darn sure that it was not going to go anywhere. But there is new biocontainment technology in laboratories that could very possibly allow us to carry out the research in some other place.

Mr. DURBIN. Are you in the process of evaluating the rational for a Plum Island type facility and our current needs?

Mr. PLOWMAN. We are in the process of a study now.

Mr. DURBIN. This article dealt with the privatization of Plum Island. And the conclusion one would reach from this article was that it was not a successful endeavor. There appears to have been serious problems when efforts were made to bring in a private company to do a lot of work on Plum Island.

Can you tell me your conclusion on that experiment?

Mr. PLOWMAN. Yes, that's a controversial issue. The government was instructed to privatize the things that they could. And we privatized the service components of some of our laboratories around the country. We went through that process at Plum Island. When

you go through the process, you develop a statement of work, and then private industry bids on that statement of work. The government also bids on it.

Well, when we put all that together, private industry said it could do it cheaper than government. That is the whole philosophy. If they can do it cheaper, they ought to. So we went through that process. Private industry won the bid. When ARS converted support services at Plum Island to the private company, 105 permanent employees and 9 temporary employees were terminated. Ten employees were offered positions with ARS at lower grades.

Now, there were many unhappy people at Plum Island that worked for the government. The private contractor picked up 69 ARS employees. Part of the problem and controversy there is because the people that lost their jobs complained. So that is part of the controversy up there. But we haven't compromised the safety aspects.

Mr. DURBIN. Well, this article, and I am sure you've read it or heard about it——

Dr. PLOWMAN. I've read that one and 40 others.

Mr. DURBIN [continuing]. Suggests that because of the rising operating cost because of this privatization, spending for research drops this year. Also, the government withheld part of the award for operating the center because of their disappointment with the company's performance. The article talks about—I find this really surprising—$91,000 Congress appropriated for research into foreign animal disease went to the private company for legal fees to fight unionization on Plum Island. Is that true?

Dr. PLOWMAN. I read that too, and we are looking into that. It's like everything you read, you can only believe part of it.

Mr. DURBIN. I want to know which part to believe.

Dr. PLOWMAN. We will submit for the record, information to clarify any issues in that regard.

[The information follows:]

PLUM ISLAND

ARS did not spend $91,000 through our Contract with Burns and Roe Services Company (BRSC) to prevent unionization at the Plum Island Animal Disease Center (PIADC). BRSC retained a legal firm to ensure that both BRSC and their employee's rights were represented before the National Labor Relations Board, and that the five unions interested in representing BRSC employees at PIADC had appropriate jurisdiction. The legal fees for these activities ($91,000) were passed to ARS as and allowable expense under the Federal contracting regulations. Of the five unions that had initially approached BRSC employees, one was granted jurisdiction to represent guard services (6 employees), has held an election and was certified. These are interim billings that will be subject to final audit by the cognizant Federal audit agency.

Mr. DURBIN. I won't dwell on this. But if this is true, it says we spend $3 for roads, electricity, special ferries and other expenses at Plum Island for every dollar that is spent on research.

Dr. PLOWMAN. Part of that is true, but that is not the whole story. We have spent less money on research than we did previously because of the high cost of operating on an island. We had to buy and repair a few boats. It is the only way we can get people out there, since we don't have special appropriations to buy things

like that. The dock blew down, a major cable that runs the electricity over there had to be replaced.

We had to do work on an incinerator and things like that. It only comes from one place. We don't have a separate budget for that. So those things that had to be done to maintain the infrastructure and we had to spend money on that.

Mr. DURBIN. I understand that and I understand your predicament in keeping the laboratory working. I think it goes to the question of whether or not it is necessary to have a separate island for this and whether we are spending much more money than is necessary to deal with the problem.

Dr. PLOWMAN. No one would like to move off of there more than we, if it can be done safely and more efficiently.

Mr. DURBIN. Can you give us a time frame on when you will be deciding?

Dr. PLOWMAN. We will have a study finished this summer and we will be able to make some recommendations at that time. But in the meantime—I must tell you that a lot of people think that—if we get a favorable study that you can go do it some other place. But we are a long time from making that decision and having another place to do it. And in the meantime, it is necessary for us to do the things that we have to do to continue to operate on Plum Island. I estimate it will take us 10 years, even if we decide to move at all.

ARS BUDGET REQUEST

Mr. DURBIN. Would you please describe your budget request to the Office of the Secretary and the Secretary's request to OMB. We are interested in learning your research priorities, which may differ from OMB's.

Dr. PLOWMAN. The ARS budget recommendations as they progressed through the budget process will be provided for the record.

[The information follows:]

FISCAL YEAR 1994 INCREASE PROPOSALS—EXECUTIVE HISTORY

[In thousands of dollars]

Program increases	Agency request	Department estimates
Soil, water, and air sciences:		
Water quality and conservation	+$5,000	+1,000
Rangeland enhancement	+2,000	
Reduce soil erosion in response to SCS	+2,000	
Global change	+1,000	
	+10,000	+1,000
Plant sciences:		
Reduce use of pesticides	+11,000	+8,500
Sweet potato whitefly		+964
Genetic resources	[1] +12,000	+6,200
Narcotic plants	+2,000	
	+25,000	+15,664
Animal sciences:		
Waste management	+5,000	+1,000
Livestock health in support of APHIS	+3,000	+1,300

FISCAL YEAR 1994 INCREASE PROPOSALS—EXECUTIVE HISTORY—Continued

[In thousands of dollars]

Program increases	Agency request	Department estimates
	+8,000	+2,300
Commodity conversion and delivery:		
New uses	+7,000	+8,000
Reduce food residues	+4,000	+4,000
Biofuels	+4,000	+7,248
Market expansion of agricultural commodities	+4,000	
	+19,000	+19,248
Human nutrition:		
Human nutrition	+11,000	+10,000
Integration of agricultural systems:		
Farming systems	+4,000	+500
Pay costs	+18,999	+19,705
SES lump sum	+1,326	
Inflation	10,152	
Total program	+107,477	+68,417

[1] Includes $2 million for animal germplasm and genome mapping.

FISCAL YEAR 1994 INCREASE PROPOSALS—BUILDINGS AND FACILITIES

	Agency request	Department estimates
National Rice Research Center, Stuttgart, AR	$10,000	
Horticultural Crop and Water Management Research Laboratory, Parlier, CA	3,200	$2,800
U.S. Salinity Laboratory, Riverside, CA	4,700	
Western Regional Research Laboratory, Albany, CA	13,800	4,700
U.S. National Arboretum, Washington, DC	1,000	
Horticultural Research Laboratory, Orlando, FL	2,500	1,800
Poultry Disease Laboratory, Athens, GA	2,700	2,700
Rearing and Genetics and Tropical Fruit and Vegetable Laboratory, Hawaii	1,400	
National Animal Disease Center, Ames, IA		3,900
National Pig Research Center, Ames, IA	24,100	
National Center for Agricultural Utilization Research, Peoria, IL	13,200	13,200
Southern Regional Research Center, Peoria, IL	9,300	3,600
Beltsville Agricultural Research Center, Beltsville, MD	20,000	20,000
USDA Avian Disease Control Laboratory, East Lansing, MI	5,100	
North Central Soil Conservation Laboratory, Morris, MN	3,200	
Plum Island Animal Disease Center, Greenport, NY	10,000	6,000
U.S. Vegetable Laboratory, Charleston, SC	17,000	
Plant Stress and Water Conservation Laboratory, Lubbock, TX	11,500	
Subtropical Agricultural Research Laboratory, Weslaco, TX	742	
Total buildings and facilities	153,442	58,700

ACID RAIN

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with research on acid rain.

Dr. PLOWMAN. ARS has conducted experimental studies of simulated acid rain on soil microbial populations, as well as theoretical studies as part of our hydrology and wind erosion research programs to help predict how dust from agricultural lands might affect the severity of acid rain at downwind locations. Research re-

sults show that acid rain is a far greater threat to lakes and forests than it is to cropland. This research has been concluded and increased emphasis has now been placed on the effects of increased CO_2, ozone and global change on agricultural production. Several ARS locations are used as monitoring sites for the National Acid Deposition Program, but this is the extent of our current program on acid rain. This research is coordinated through our Raleigh, North Carolina, location.

Mr. DURBIN. Please provide for the record the funding and staff for acid rain research for fiscal years 1992, 1993 and 1994, by location.

Dr. PLOWMAN. Funding for acid rain research in fiscal year 1992 was $414,000 and 1.2 scientists were assigned to this research. We have no plans to fund acid rain research in fiscal years 1993 and 1994.

AFLATOXIN RESEARCH

Mr. DURBIN. Please describe for the Committee the work you have underway on aflatoxin.

Dr. PLOWMAN. ARS research on aflatoxin is directed toward the prevention and control of aflatoxin in commodities of plant origin, that is, peanuts, corn, cottonseed, and tree nuts. Research approaches include conventional breeding to identify natural resistance in crops, and bioengineering to enhance natural resistance where possible. Biocontrol agents are another promising control mechanism and ARS is developing naturally occurring non-aflatoxin producing strains of *Aspergillus flavus* and *A. parasiticus* that will displace the toxin producing strains. ARS research also continues to learn how to manipulate agronomic and ecological factors and postharvest handling to minimize conditions conducive to aflatoxin formation. Other research continues and expands upon initial success in the regeneration of transformed peanut plants and the identification of an aflatoxin regulatory gene from *A. flavus*.

Mr. DURBIN. By location, please indicate the dollars and staff years devoted to aflatoxin research in fiscal years 1992, 1993, and 1994.

Dr. PLOWMAN. The dollars and staff years devoted to aflatoxin research will be provided for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Albany, CA	$837,100	2	$886,600	2	$898,239	2
Dawson, GA	761,300	2	760,900	2	770,889	2
Mississippi State, MS	601,000	2	600,900	2	608,789	2
New Orleans, LA	2,275,900	10	2,275,000	10	2,305,778	10
Peoria, IL	1,325,500	7	1,325,400	7	1,342,901	7
Tifton, GA	604,800	3	556,800	3	564,110	3
Headquarters	891,000		891,900		891,900	
Total	7,297,500	26	7,297,500	26	7,382,606	26

AGRICULTURAL RESEARCH AND DEVELOPMENT CONSORTIUM

Mr. DURBIN. Please describe for the Committee the work underway at the Agricultural Research and Development Consortium.

Dr. PLOWMAN. This consortium was incorporated in 1988 as the Biotechnology Research and Development Corporation—BRDC for short. The consortium is based at the ARS National Center for Agricultural Utilization Research or NCAUR, at Peoria, Illinois. A number of major U.S. companies now participate in BRDC, including American Cynamid Company, Amoco Technology Company, The Dow Chemical Company, Hewlett-Packard Company, IMCERA Group, Inc., and Agricultural Research and Development Corporation. At least two additional companies are expected to join BRDC in 1993. BRDC uses funds received from a variety of sources—federal grants, the participating companies, a grant from the State of Illinois, and licensing revenues—to support cutting-edge agricultural biotechnology research projects in federal and academic laboratories. Projects supported by BRDC are selected by a Scientific Advisory Board comprised of representatives from the participating companies, the USDA Agricultural Research Service, and two Land Grant universities, the University of Illinois and Iowa State University. This diversity helps assure that research projects supported by BRDC are of high scientific quality, are relevant to national goals and priorities, and have a high probability of achieving commercial success.

Since its inception in 1988, BRDC has funded a total of 95 research projects at 25 different locations across the United States, representing a total commitment of $23.9 million. This research has resulted in more than 50 inventions. To date, BRDC has filed more than two dozen United States patent applications. Six patents have been issued so far. BRDC has begun to license technologies developed under its support to the participating companies and other interested companies, and is using the resulting licensing revenues to support additional research.

Mr. DURBIN. Please describe the research proposals that have been funded by the Consortium.

Dr. PLOWMAN. BRDC funds research projects in several different scientific disciplines related to agricultural biotechnology. In the area of plant molecular biology, BRDC supports the development of technologies that can be used by government, academic, and corporate researchers to facilitate the development of transgenic plants. BRDC supports research on the molecular biology of lower organisms, such as fungi and bacteria, with the aim of developing new fermentation technology for converting low-cost agricultural feedstocks into higher value products. Related programs aimed at developing new, biocatalytic routes to synthesize high-value intermediates from agricultural feedstocks are also supported, as are projects to develop improved fermentation process control sensors. Technology for the efficient separation and recovery of products from fermentation or biocatalytic production systems is also being developed by BRDC. BRDC supports research programs to identify natural products, compounds already present in nature, that can be used as environmentally friendly herbicides, pesticides, or fungicides. BRDC is supporting the development of new starch encapsu-

lation technology that allows efficient and economical use of biocontrol agents such as Bacillus thuringiensis toxin or baculovirus for agricultural pest control. Finally, BRDC supports research in the area of animal health care, with projects ranging from the development of simple genetic tests for accurately predicting pig litter size to the development of vaccines for diseases of production animals.

Mr. DURBIN. Please provide information for the record indicating a funding history for the Consortium.

[The information follows:]

ARS support of BRDC has been about $1,757,000 annually since its inception in 1988 and continues at this level in Fiscal Years 1991 through 1994.

ANIMAL HEALTH CONSORTIUM

Mr. DURBIN. Please describe the work carried out by the Animal Health Consortium at Ames, Iowa.

Dr. PLOWMAN. The Animal Health Consortium was established in fiscal year 1990 among the ARS National Animal Disease Center, Iowa State University, and approximately 10 private companies for the purpose of furthering the commercialization of new and advanced animal health products. The Consortium has completed staffing for administrative management at Iowa State University.

In 1992, the Consortium had 18 active funded projects. Funded research includes recombinant vaccine or immunity studies on calfhood rotavirus diarrhea, bovine pneumonic pasteurellosis, mycotoxins, bovine respiratory syncytial virus, helminth parasites, and mucosal defense; ruminal microbiology and metabolism; swinepox expression vectors; Mycoplasma cloning hosts; bovine mastitis; molecular genetics; germplasm and breeding; and genotyping of the swine major histocompatibility complex. Additional projects are scheduled for funding in 1993.

Mr. DURBIN. What private funds does the consortium receive?

Dr. PLOWMAN. At this time, three corporations have joined the Animal Health Consortium—Amoco, Pitman-Moore, and American Cynamid. Each affiliate company has contributed $100,000 per year during fiscal years 1991, 1992, and 1993. It is anticipated that these contributions of $100,000 per company will continue for fiscal year 1994.

Mr. DURBIN. How is the consortium affiliated with the ARS Biotech Consortium at Peoria, Illinois?

Dr. PLOWMAN. The Animal Health Consortium was incorporated into the Biotechnology Research and Development Corporation, Peoria, Illinois, as a subdivision called the Animal Health Care Division. The administrative office of the Animal Health Care Division remains in Ames, Iowa.

AQUACULTURE RESEARCH

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with aquaculture research by location.

Dr. PLOWMAN. The work ARS is doing in aquaculture, by location, will be provided for the record.

[The information follows:]

Auburn, AL—Immunity, diagnosis, diseases, and parasites of cultured fish.
Honolulu, HI—Tropical aquaculture, culture and feed technology.
Kanehoe, HI—Requirements and sources of nutrients for marine shrimp.
New Orleans, LA—Improving flavor quality of farm-raised catfish.
Stoneville, MS—Improving breeding, genetics, and endocrinology of catfish.
Lane (Tishomingo), OK—Improving flavor and storage quality of catfish and improving methods to increase catfish production and efficiency.
Kearneysville, WV—Water quality control.
Fargo, ND—Aquaculture feeds research.
College Station, TX—Food safety of catfish.

Mr. DURBIN. By location, what is the funding or staff for aquaculture research for fiscal years 1992, 1993 and 1994?

Dr. PLOWMAN. The funding and scientists for aquaculture by location will be provided for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Auburn, AL	$846,500	3.0	$846,400	3.0	$857,500	3.0
Honolulu, HI	1,609,900		1,609,900		1,663,700	
Kaneheo, HI	162,700	1.0	162,700	1.0	164,800	1.0
New Orleans, LA	820,400	3.3	678,200	3.2	687,100	3.2
Stoneville, MS	1,017,200	3.0	1,016,400	3.0	1,029,700	3.0
Lane, OK	512,300	2.0	512,300	2.0	519,000	2.0
Kearneysville, WV	1,472,200		1,472,200		1,472,200	
Fargo, ND	325,000		325,000		325,000	
College Station, TX	371,600		371,600		371,600	
Total	7,137,800	12.3	6,994,700	12.2	7,090,600	12.2

AQUACULTURE RESEARCH CENTER

Mr. DURBIN. Please describe the site analysis for an aquaculture research center.

Dr. PLOWMAN. The ARS assembled a panel of experts to establish technical site criteria for a coldwater aquaculture research center. I will provide the criteria for the record.

[The information follows:]

1. A continuous water supply from a spring or well with a flow rate of 1,000 gallons per minute during minimum flow, as dependence on surface water sources, is not acceptable because water quality and temperature cannot be consistently controlled to the range suitable for cold water fish production and research. Water temperature must be in the range of 50 to 60 degrees F. year-round and, in addition, an on-site supplemental source of surface water, such as from a stream, river, or lake, would be a desirable feature but not essential. The water should meet quality standards for optimum health and reproduction of rainbow trout.
2. The Center should own or lease the immediate watershed surrounding the spring or well in order to have long-term control of the land use that may affect the quality of the water supply.
3. The site must have suitable land area and topography to accommodate the research laboratory/office building, wet laboratory facility, production units, and effluent processing units. The Center would occupy 50 to 100 acres with some buffer area required on the perimeter. Adequate road access to and within the Center property would be needed.
4. Effluent discharge is an important consideration for an aquaculture research center. Important site analysis aspects include biological containment, water quality, facilities for effluent treatment and recirculation, and natural or constructed wetland to restore water quality.

ARS is in the process and evaluating potential locations.

Mr. DURBIN. What funds were devoted to this proposal in fiscal years 1992 and 1993?

Mr. PLOWMAN. This proposal was funded from available Headquarters funding in fiscal year 1992. In fiscal year 1993, $300,000 was reserved from available funds to devote to this project.

Mr. DURBIN. If this proposed center were funded, what would be the construction costs and what would be the annual operating costs?

Dr. PLOWMAN. It is projected that the center would house 11 scientists. Based on this projected number of scientists, the construction would cost about $10 to $12 million and the annual operating costs about $4 million.

BARLEY YELLOW DWARF VIRUS

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with barley yellow dwarf virus, by location.

Dr. PLOWMAN. The goal of ARS barley yellow dwarf—or BYD—virus research program is to develop and transfer to barley, oat, and wheat producers technology to prevent or reduce economic losses due to the BYD virus. This is to be achieved by development of crop germplasm lines and new varieties with improved BYD virus infection immunity, resistance, or tolerance. In addition, there will be development of cultural production systems based on BYD virus resistant or tolerant crop varieties and suppression of BYD virus insect vector populations.

The BYD virus research to Albany, California, is directed toward the transfer of plant genes that specifically confer resistance or tolerance to BYD virus and/or to insect vectors of the virus into agronomically useful and acceptable cereal varieties.

The purpose of the research at Ithaca, New York, is to characterize the viral pathogen and develop technologies to detect the virus in plants and in insect vectors. This research includes determination of the structure, reproduction, and movement of the virus in the host plant and in insect vectors.

The purpose of the research at West Lafayette, Indiana, is to determine which insect species spread the various strains of BYD virus and to determine the biology of the insects, feeding behavior on plants, and migration habits within fields over long distances.

The research at Brookings, South Dakota; University Park, Pennsylvania; and Urbana, Illinois, is directed toward evaluation of plant germplasm for resistance to the virus and several species of insect vectors that feed on cereal crops, development of improved germplasm and new varieties of cereal crops, and development of disease management strategies based on the biology of the disease under natural conditions.

The research at Lincoln, Nebraska, is concerned with the development of BYD virus strain detection and identification methods.

The research at Aberdeen, Idaho, is a component of an overall effort, coordinated from Aberdeen, which is evaluating oat germplasm for important traits, including resistance to BYD virus.

Mr. DURBIN. By location, what is the funding and staff for barley yellow dwarf virus research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The information will be provided for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Albany, CA	$248,300	1.0		0.0		0.0
Brookings, SD	62,800	0.1	$62,800	0.1	$63,600	0.1
Lincoln, NE	29,300	0.1	29,300	0.1	29,700	0.1
Ithaca, NY	171,100	1.0	171.100	1.0	173,300	1.0
University Park, PA	41,100	0.1	41,100	0.1	41,600	0.1
Urbana, IL	279,300	2.0	279,300	2.0	283,000	2.0
West Lafayette, IN	158,300	0.2	261,300	1.0	264,700	1.0
Aberdeen, ID			15,200	0.1	15,400	0.1
Total	990,200	4.5	860,100	4.4	871,300	4.4

BIODEGRADABLE PLASTIC

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with biodegradable plastic, by location.

Dr. PLOWMAN. Development of totally biodegradable plastic based on starch is being carried out at the National Center for Agricultural Utilization Research or NCAUR, Peoria, Illinois. While some plastic items like disposable dinnerware can be made totally from starch, these items lack the required properties to be widely acceptable. At NCAUR scientists are preparing composites of starch and other biodegradable polymers by extrusion and injection molding technology to impart the water resistance, flexibility and strength properties to meet requirements for many onetime use plastic articles. Biodegradable vegetable oils and waxes are being evaluated as processing aids and additives to improve properties. The rate and extent of biodegradability of the materials in soil and water and under composting is determined at NCAUR. Under a cooperative agreement with the Natick Research and Development Center, Natick, MA biodegradable items to be disposed of at sea by the Navy are being developed. A 90 percent starch foam for packing was developed under a cooperative agreement with a research institute and introduced commercially in late 1992. The first commercial product resulting from a cooperative agreement with a company to develop starch-natural polyester resins for a broad range of plastic articles will be introduced in 1993.

Mr. DURBIN. By location, what is the funding and staff for biodegradable plastic research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. A table showing, by location, the funding and staff for biodegradable plastic research for fiscal years 1992, 1993, and 1994 will be provided for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Peoria, IL	$1,455,200	7.4	$1,455.200	7.4	$1,474,300	7.4
Philadelphia, PA	710,600	3.1	710,600	3.1	719,900	3.1
Albany, CA	492,400	2.4	492,400	2.4	498,900	2.4

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Total	2,658,200	12.9	2,658,200	12.9	2,693,100	12.9

BIOFUELS RESEARCH

Mr. DURBIN. Please describe for the Committee the work you are doing with biofuels research, by location.

Dr. PLOWMAN. We have research on biofuels at three locations. The objectives of the research by location will be provided for the record.

[The information follows:]

Peoria. IL—Develop improved biochemical technologies and fermentation systems for conversion of agricultural commodities, primarily corn to ethanol. Develop technology to convert the corn residues from ethanol fermentations into nonfood biomaterials. Formulate and evaluate vegetable oil-based diesel fuels with improved combustion properties, with emphasis on soybean oil.

Philadelphia, PA—Develop optimal process technologies and systems to recover ethanol, remove water, and separate co-products from fermentation media.

Tifton, GA—In cooperation with the University of Idaho, develop higher yielding rapeseed cultivars, improve processes for converting rapeseed oil to biodiesel, and evaluate performance of the biodiesel in conventional engines.

Mr. DURBIN. By location, what is the funding and staff for biofuels research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. We will provide funding and staff information for biofuels research for fiscal years 1992, 1993, and 1994 for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Peoria, IL	$1,744,400	5.0	$1,741,900	5.0	$2,564,900	6.0
Philadelphia, PA	611,100	4.4	833,200	4.4	1,744,200	5.4
Tifton, GA	201,000	0.1	200,900	0.1	203,600	0.1
Total	2,556,500	9.59	2,776,000	9.5	4,512,700	11.5

BLUEBERRY AND CRANBERRY RESEARCH

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with blueberries and cranberries, by location.

Dr. PLOWMAN. A description of blueberry and cranberry research by location will be provided for the record.

[The information follows:]

Booneville, AR—Evaluation of existing varieties for adaptation to south-central production areas and cultural studies.

Peoria, IL—Potential control of blueberry postharvest fungal diseases by natural plant product extracts.

Beltsville, MD—Germplasm evaluation, variety development, and root adaptation to upland pH-neutral soils.

Poplarville, MS—Breeding, field testing, and introduction of new varieties adapted to Gulf States; cultural studies; and disease control.

Chatsworth, NJ—Genetics and breeding of new improved varieties and pest control; epidemiology and biocontrol of diseases.

Lane, OK—Postharvest practices to reduce disease losses and increase marketability.
Corvallis, OR—Germplasm preservation and evaluation.
Kearneysville, WV—Aquaculture-linked hydroponic cropping systems.

Mr. DURBIN. By location, what is the funding and staff for blueberry/cranberry research for fiscal years 1992, 1993, and 1994?

Dr. POLWMAN. The funding and staff for blueberry/cranberry research for fiscal years 1992, 1993, and 1994 will be provided for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Booneville, AR	$45,600	0.5	$45,600	0.5	$46,200	0.5
Beltsville, MD	299,000	2.9	462,700	2.9	468,900	2.9
Poplarville, MS	374,000	1.5	374,000	1.5	378,800	1.5
Chatsworth, NJ	566,900	2.8	566,900	2.8	574,500	2.8
Lane, OK	78,600	0.3				
Corvallis, OR	68,000	0.2	68,000	0.2	68,900	0.2
Peoria, IL	42,200	0.2	47,800	0.2	48,400	0.2
Kearneysville, WV	109,000	0.9	109,000	0.9	109,200	0.9
Total	1,583,500	9.3	1,674,000	9.0	1,694,900	9.0

BRUCELLOSIS RESEARCH

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with brucellosis research, by location.

Dr. PLOWMAN. The ARS bovine brucellosis program involves intramural and extramural research to develop improved attenuated and genetically engineered vaccines and diagnostic procedures, to improve vaccination methodology, to characterize the genetic loci in the bacteria that code for virulence and immunogenicity, and to determine genetic mechanisms of resistance to Brucella infection.

The National Animal Disease Center in Ames, Iowa, is developing a diagnostic test that will differentiate between vaccinated and infected animals and is evaluating a recently developed test to measure antibacterial activity of cattle white blood cells and to quantitate the host response to *Brucella abortus* infection. Gene deletion mutants of B. abortus vaccine strain 19 are being tested in cattle as potential vaccine candidates. The mutants lack one or more of the major protein antigens. If these vaccines provide protection, serologic testing for the missing protein would allow differentiation of vaccinated and naturally infected animals. At least one mutant has shown significant promise as a vaccine by protecting vaccinated cattle against bacterial challenge without producing antibody measurable in normal serologic testing. Genetic studies are continuing to differentiate isolate of B. abortus from cattle, elk, and bison.

Mr. DURBIN. By location, what is the funding and staff for brucellosis research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The funding for brucellosis research at the National Animal Disease Center, Ames, Iowa, in fiscal year 1992 is

$3,249,500. In fiscal year 1993, it is $2,829,300, and in fiscal year 1994, it is $2,866,400. The staffing is 9 scientists for all years.

CALICIVIRUS

Mr. DURBIN. Please describe the work you have underway on calicivirus.

Dr. PLOWMAN. Research is underway on sequencing the genes of the calicivirus responsible for vesicular exanthema disease in swine and of related caliciviruses. Comparative studies on the known caliciviruses including vesicular exanthema virus affecting swine, San Miguel virus affecting sea lions, and feline caliciviruses affecting cats are being conducted to identify the sequences that determine virulence, serologic variability, and host specificity.

Viral genomic RNA is being used to determine how the viral infection is initiated at the cellular level. Current studies suggest that all animal caliciviruses share the same cellular receptor site for virus attachment.

Studies on the genetic factors controlling host range specificity are of practical value because it is hypothesized that vesicular exanthema virus of swine was a host-adapted variant of a common calicivirus of marine mammals. However, current gene sequence research suggests that multivalent vaccines would provide better animal protection that monovalent vaccines.

Mr. DURBIN. By location, what is the funding and staff for calicivirus research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The funding and scientific staff for calicivirus research remained unchanged during fiscal years 1992 and 1993 at $219,900 and supported by 1.0 scientist each year. In 1994, the funding will be $222,800 and continue to be supported by 1.0 scientist. The ARS calicivirus research program is located at the National Animal Disease Center, Ames, Iowa.

COMPOSTING RESEARCH

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with composting research by location.

Dr. PLOWMAN. We have research on composting at three locations. At Clay Center, Nebraska, we evaluate composting procedures for feedlot manures in terms of weed seed kill, hauling cost reduction, cost of composting, acceptance for agricultural and horticultural use, and effects of the composting process on adjacent surface and groundwater quality. At Corvallis, Oregon, out scientists determine feasibility and costs of composting straw from grass seed production, as an alternative to burning, and benefits derivable from use of this compost. At Rodale Research Center, Kutztown, Pennsylvania, our scientist is cooperating in dévelopment of low input, reliable, and acceptable methods for on-farm composting of agricultural municipal wastes and evaluating benefits derivable from use of the composts.

Mr. DURBIN. By location, what is the funding and staff for composting research for fiscal years 1992, 1993, and 1994.

Dr. PLOWMAN. The funding and staff for composting research for fiscal years 1992, 1993, and 1994 will be provided for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientist
Clay Center, NE			$477,000	1.5	$483,300	1.5
Corvallis, Or			230,000	1.4	233,000	1.4
Kutztown, PA	$160,000	0.2	172,200	0.7	174,500	0.7
Total	160,000	0.2	879,200	3.6	890,800	3.6

DWARF BUNT RESEARCH

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with dwarf bunt research, by location.

Dr. PLOWMAN. The dwarf bunt research on wheat at Pullman, Washington, is focused on the identification and evaluation of germplasm and new gene combinations for resistance to the disease. In addition, research on the development and improvement of integrated management systems for cereal diseases is expected to be applicable to reduced dwarf bunt disease occurrence in the field. The dwarf bunt research at East Lansing, Michigan, is directed toward identification of host resistance in wheat, development of high-yielding commercial wheat genotypes through conventional breeding and tissue culture techniques, and identification of factors related to the ecology of the pathogen and epidemiology of the disease. Research at Albany, California, is designed to ultimately allow genetic transformation and gene transfer of dwarf bunt resistance.

Mr. DURBIN. By location, what is the funding and staff for dwarf bunt research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. We will provide the information for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Albany, Ca	$184,800	0.3	$46,200	0.1		
Pullman, WA	50,200	0.1	13,900	0.1	$14,100	0.1
East Lansing, MI	$50,700	1.0	50,700	0.2	51,400	0.2
Total	285,700	1.4	110,800	0.4	65,500	0.3

EASTERN FILBERT BLIGHT

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with Eastern filbert blight by location.

Dr. PLOWMAN. ARS conducts research on Eastern filbert blight at Corvallis, Oregon. This research is focused on determining the epidemiology of the disease in order to develop reliable disease management strategies. Specifically, the objectives of this research are to determine the environmental factors that affect production and dispersal of the pathogen, and the infection process. In addition, the relative resistance of different host genotypes is being evaluated. Finally, orchard management practices that may reduce

spread of the pathogen and disease development are being developed.

Mr. DURBIN. By location, what is the funding and staff for Eastern filbert blight research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The funds for Eastern filbert blight research at Corvallis, Oregon, in fiscal year 1992 were $208,200. For fiscal years 1993 and 1994, anticipated funding is $208,200 and $210,900, respectively. We have 1.1 scientists working on Eastern filbert blight in each year.

ENDOPHYTE RESEARCH

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with endophyte research at the Universities of Missouri and Arkansas.

Dr. PLOWMAN. ARS is providing administration and oversight for the funds used for endophyte research at the University of Arkansas and University of Missouri. Research emphasis for these cooperative projects includes toxin identification and characterization, genetic resistance to endophyte in fescue, and animal studies with endophyte containing fescue.

Mr. DURBIN. What is the funding and staff for endophyte research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The funding for endophyte research for fiscal years 1992, 1993, and 1994 is $180,000. The Universities of Arkansas and Missouri provide staff to conduct the research.

FRUIT FLY ERADICATION PROGRAM

Mr. DURBIN. What has happened on the fruit fly eradication project in Hawaii during the past 12 months?

Dr. PLOWMAN. During the past year, we released sterile medflies on Kauai at the rate of 100–150 million per week. The release area was expanded from commercial coffee to include remote areas with wild stands of coffee. Helicopters were adapted for fly release and used for the remote sites. The results from these studies indicate that medfly eradication can be achieved in noncommercial host areas using sterile insects alone. However, the eradication from commercial coffee acreages is not operationally feasible. The numbers of sterile flies that would be required to reach the sterile wild fly ratio needed for eradication on the 6000–7000 acres of commercial coffee substantially exceed the production capacity of the APHIS Fruit Fly Rearing Facility at Waimanalo. Field studies were conducted to evaluate a males-only strain of medfly. The results from these studies indicated that male fly releases had several biological advantages over releases of both sexes. The program on Kauai was interrupted approximately 2 months by damage from Hurricane Iniki, but it is now back in full operation.

Mr. DURBIN. What are the plans for the remainder of fiscal years 1993 and 1994?

Dr. PLOWMAN. We plan to conduct field studies to evaluate a genetically derived, males-only strain of medfly and to evaluate nonpesticidal means of reducing medfly populations in commercial coffee. The potential population suppression methods to be evaluated in coffee include augmentative parasite releases and mass trap-

ping with slow release tacky traps. We also plan to initiate studies on the feasibility of eradicating oriental fruit flies from Hawaii.

Mr. DURBIN. By location, what is the budget for this project for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The budget allocated specifically for fruit fly eradication research on Hawaii in fiscal year 1992 was $2,667,000. Estimated budgets for 1993 and 1994 are $3,064,000 and $3,104,000, respectively. Additionally, ARS obligates about 1.5 million dollars in base funds each year to conduct research in support of the eradication pilot studies.

GERMPLASM

Mr. DURBIN. By location, what is the funding and staff for germplasm facilities for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The estimated ARS funding and scientist years for the major plant germplasm repository and research facilities will be provided for the record.

[The information follows:]

Respository	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Davis, CA	$573,200	4.0	$573,100	4.0	$580,600	4.0
Riverside, CA	385,300	3.0	385,200	3.0	390,300	3.0
Ft. Collins, CO	2,294,100	39.0	2,466,200	39.0	2,498,600	39.0
Washington, DC	417,600	2.0	417,600	2.0	422,800	2.0
Miami, FL	457,200	5.0	473,600	5.0	479,800	5.0
Griffin, GA	1,512,100	7.0	1,511,500	7.0	1,531,300	7.0
Honolulu/Hilo, HI	395,300	3.0	395,300	3.0	400,500	3.0
Ames, IA	1,588,400	9.0	1,688,200	9.0	1,710,400	9.0
Aberdeen, ID	955,700	4.0	854,400	4.0	865,600	4.0
Urbana, IL	701,300	4.0	620,900	4.0	629,100	5.0
Beltsville, MD	4,245,600	14.0	4,329,200	14.0	4,386,000	14.0
Stoneville, MS	126,200	0.4	126,200	0.4	127,900	0.4
Oxford, NC	46,600		46,600		47,200	
Fargo, ND	492,200	1.0	492,100	1.0	498,600	1.0
Geneva, NY	1,328,600	9.0	1,328,600	9.0	1,346,000	9.0
Corvallis, OR	577,000	3.0	576,900	3.0	584,500	3.0
Mayaguez, PR	729,900	2.0	729,500	2.0	739,100	2.0
Brownwood, TX	118,400	1.0	118,400	1.0	120,000	1.0
College Station, TX	553,400	3.0	553,400	3.0	560,700	3.0
Logan, UT	145,500	0.7	145,500	0.7	147,400	0.7
Pullman, WA	1,126,100	13.0	1,126,000	13.0	1,140,800	13.0
Madison/Sturgeon Bay, WI	243,400	2.0	243,400	2.0	246,600	2.0
St. Croix, VI	313,800	3.1	313,700	3.1	317,800	2.1
Headquarters	1,215,400		861,800		861,800	
Total	20,542,300	132.2	20,377,300	132.2	20,633,400	132.2

GERMPLASM COLLECTIONS

Mr. DURBIN. For the record please list the germplasm collections that are maintained by ARS.

[The information follows:]

The major germplasm collections maintained by ARS are as follows:

Davis, CA—almond, fig, grape, kiwi, mulberry, olive, persimmon, pistachio, pomegranate, stone fruit, and walnut.

Riverside, CA—citrus and related genera, and dates.

Salinas, GA—lettuce genetic stocks.

Fort Collins, CO—base seed collection of major economic crops.
Washington, DC—numerous woody landscape genera.
Miami, FL—annona, avocado, carambola, mango, passiflora, sugarcane, and Tripsacum.
Griffin, GA—cowpea, melon, peanut, pepper, sorghum, and sweetpotato.
Tifton, GA—pearl millet.
Hilo, HI—acerola cherry, atemoya, breadfruit, guava, litchi, macadamia, papaya, passion-fruit, peach palm, pili nut, pineapple, rambutan, and starfruit.
Ames, IA—alfalfa, cabbage, maize, melon, sugarbeet, sunflower, and soybean genetic stocks.
Aberdeen, ID—barley, oat, rice, rye, triticale, and wheat.
Urbana, IL—soybean and maize genetic stocks.
Columbia, MO—triticale and wheat genetic stocks.
Oxford, NC—tobacco collection.
Fargo, ND—durum wheat genetic stocks and flax.
Geneva, NY—apple, brassicas, celery, clover, hardy grape, squash, and tomato.
Corvallis, OR—blackberry, blueberry, cranberry, current, filbert, gooseberry, hop, mint, pear, raspberry, and strawberry.
Mayaguez, PR—banana, Brazil nut, cacao, coffee, mango, and plantain.
Brownwood, TX—chestnut, hickory, and pecan.
College Station, TX—cotton and cotton genetic stocks, and sorghum genetic stocks.
Logan, UT—range grass collection.
Pullman, WA—alfalfa, bean, chickpea, grasses, lentil, onion, pea, and safflower.

PLANT GERMPLASM IN RUSSIA

Mr. DURBIN. What contact has ARS had with the Institute of Plant Industry in St. Petersburg, Russia?

Dr. PLOWMAN. ARS has had a long-standing interest in and interaction with the N.I. Vavilov Institute—or VIR—in St. Petersburg. ARS has exchanged plant genetic resources with VIR and assisted with visits of scientists to and from the Institute. VIR has facilitated numerous plant collecting trips of ARS scientists over the past five years. Most recently, the agency developed a program of cooperation which covers germplasm collecting, evaluation, preservation and documentation in addition to exchange. ARS and VIR are cooperating to develop a computerized inventory of plant germplasm.

Mr. DURBIN. What other major plant germplasm collections exist in the former Soviet Union and what is their current status?

Dr. PLOWMAN. In the former Soviet Union, plant germplasm collections consisted of two principal types: botanical and agricultural. Collections of mostly non-consumable species were held at some 70 botanical gardens, under the auspices of the USSR Academy of Sciences and local universities. Today, there are 58 botanical gardens in Russia, each keeping about 4,000 species.

Most of the agricultural and miscellaneous collections were managed by the N.I. Vavilov Institute or VIR, and its affiliated stations. Breeders at breeding institutes had and have their own collections of advanced lines, germplasm and developmental material. There were 18 stations in the VIR network in addition to the institute at St. Petersburg, Russia. The stations kept duplicate samples of seed-propagated germplasm when they grew out samples for Kuban, the long-term storage facility, and VIR. Today, VIR has an inventory of about 380,000 different seed collections. In addition, the following VIR stations had collections of vegetatively-propagated germplasm, such as fruit and nut crops: Volgograd Station, Daghestan Station, Vladivostok Station, Krymsk Breeding Station,

Maikop Station, and the Polar Station. Outside of the VIR network, the Russian Institute of Medicinal and Aromatic Plants conserves a collection of 1000 medicinal plants.

Former VIR stations which also had fruit crop collections included: Aral Sea Area Experiment Station in Kazakhstan, Kara Kala Experiment Station in Turkmenistan, Ustimovskaya Station in the Ukraine, Crimean Pomological Station in the Ukraine, Central Asia Branch Experiment Station in Uzbekistan, and the Sukhumi Experiment Station in Georgia. The Sukhumi Station, ravaged by the war, also had a unique collection of volatile oil plants, but the status of the Sukhumi collections is unknow at present. The Kara Kala Station presently desires to retain its status within the VIR network. Lastly, a new Ukrainian national collection is being developed in the Institute of Plant Production in Kharkov based upon the VIR collection.

Efforts to ensure the continuity and integrity of the collections has been coordinated between the USDA's Agricultural Research Service and Office of International Cooperation and Development, the World Bank, the Consultative Group on International Agricultural Research, the Department of State's Agency for International Development and Office of Oceans, Environment, and International Science. The CGIAR has established a special account where individuals, foundations, and donor governments can place funds to support the many activities of VIR and the former network stations. The International Board for Plant Genetic Resources—IBPGR—is managing the funds and is accountable to donors for the directed or general use. Additional information for donors can be obtained from the Agricultural Research Service's National Genetic Resources Program.

Mr. DURBIN. For the record, please list other major germplasm collections and their locations.

Dr. PLOWMAN. Besides the extensive germplasm collections at the U.S. National Seed Storage Laboratory at Fort Collins, Colorado and at St. Petersburg, Russia, diverse major collections are held in Beijing, China, Addis Ababa, Ethiopia, and New Delhi, India. Large, crop-specific collections are held by many countries and at International Agricultural Research Centers in developing countries. Some examples of large crop-specific collections in long-term storage will be provided for the record.

[The information follows:]

CROP, LOCATION, AND ORGANIZATION

Barley; Ottawa, Canada; Agriculture Canada.

Bean; Cali, Colombia; International Center for Tropical Agriculture.

Chickpea; Hyderabad, India; International Crops Research Institute for the Semi-Arid Tropics.

Cowpea; Ibadan, Nigeria; International Institute for Tropical Agriculture.

Maize; El Batan, Mexico; International Center for Maize and Wheat Improvement.

Peanut; Hyderabad, India; International Crops Research Institute for the Semi-Arid Tropics.

Pearl Millet; Hyderabad, India; International Crops Research Institute for the Semi-Arid Tropics.

Pidgeonpea; Hyderabad, India; International Crops Research Institute for the Semi-Arid Tropics.

Potato; Lima, Peru; International Potato Center.

Rice; Los Banos, Philippines; International Rice Research Institute.
Rice; Tsukuba, Japan; National Institute of Agricultural Sciences.
Sorghum; Hyderabad, India; International Crops Research Institute for the Semi-Arid Tropics.
Wheat; Bari, Italy; Ministry of Agriculture.
Wheat; El Batan, Mexico; International Center for Maize and Wheat Improvement.

GRAPE PHYLLOXERA

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with grape phylloxera research, by location.

Dr. PLOWMAN. At the present time, ARS does not conduct research on grape phylloxera, but we have related research. Our scientists work cooperatively with University of California scientists. At Fresno, our research is directed toward development and selection of improved rootstocks. At Davis, our research is focused on determining the distribution and effects of latent viruses associated with existing phylloxera-resistant vines and on detection and elimination of viruses and virus-like agents from grape nursery stock.

GRASSHOPPER AND MORMON CRICKETS

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with research on grasshoppers and Mormon crickets.

Dr. PLOWMAN. The ARS Rangeland Insect Laboratory, Bozeman, Montana, conducts a research program on grasshopper and Mormon cricket control which focuses on environmentally compatible and publicly acceptable control technology. This includes the use of microbial pesticides, egg parasites, and the reduction of pesticides using baits in place of sprays. Additionally, the Bozeman Laboratory has greatly increased the knowledge on grasshopper population dynamics. This effort has resulted in the development of an expert system called Hopper to provide management advice to ranchers. The overall ARS program is highly coordinated with the 5-year interagency Grasshopper Integrated Pest Management Project begun in 1987 and managed by the Animal and Plant Health Inspection Service. A Grasshopper Integrated Pest Management Project 2-year technology transfer plan has been developed for fiscal years 93 and 94; technology developed by the ARS program is an integral part of the plan which includes the Hopper expert system, baits, and the egg parasite and microbial biocontrol agents.

Mr. DURBIN. By location, what is the funding for grasshopper and Mormon cricket research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The funding for grasshopper and Mormon cricket research for fiscal years 1992, 1993, and 1994 will be provided for the record.

[The information follows:]

Location	Fiscal year 1992 funds	Fiscal year 1993 funds	Fiscal year 1994 funds
Beltsville, MD	$59,400	$62,700	$63,500
Bozeman, MT	618,200	618,100	626,200
Ithaca, NY	307,700		

Location	Fiscal year 1992 funds	Fiscal year 1993 funds	Fiscal year 1994 funds
Total	985,300	680,800	689,700

GUAYULE

Mr. DURBIN. What developments have occurred in the guayule program during the past 12 months?

Dr. PLOWMAN. The United States is totally dependent upon imported natural rubber for industrial and defense purposes. The annual cost of importation of this critical material is about $1 billion. Guayule is a rubber-producing, small woody perennial shrub native to north-central Mexico and southwestern Texas.

Research and development of guayule as a new domestic natural rubber crop is currently in progress at the USDA-ARS U.S. Water Conservation Laboratory, Phoenix, Arizona, in cooperation with State Agricultural Experiment Stations in Arizona, California, New Mexico, and Texas. Breeding and genetic research has developed new selections that have nearly doubled the yield over that of currently available varieties. These new selections are undergoing evaluation throughout the Southwest, and hold promise of producing economically viable rubber yields of 1,000 lbs/acre/year. Further increases in yield through the use of plant bioregulators is the basic research objective at the ARS laboratory in Pasadena, California, while enhancement through improved management practices in irrigated and nonirrigated production is underway at Brawley, California and Weslaco, Texas.

Research this year at the USDA-ARS Western Regional Research Center, Albany, California, has demonstrated that guayule rubber latex is nonallergenic. An allergic reaction to conventional Hevea rubber latex has been shown to be life threatening to certain medical and surgical patients, and an estimated 10 percent of the medical workforce is seriously allergic to conventional rubber gloves and products. Research is in progress to determine the feasibility for using guayule latex to replace imported Hevea rubber for making medical equipment, surgical gloves, contraceptives, balloons, toys, and other products. These uses for guayule latex could generate a larger economic impact than that of rubber for tire production. Resins, another major natural product of the guayule plant, hold promise for developing coproducts such as adhesives, coatings, and biological control agents, which may have an economic value equal to or greater than the natural rubber.

Mr. DURBIN. By location, what is the funding and staff for guayule research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The funding and staff for guayule research by locations for fiscal years 1992, 1993, and 1994 will be provided for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Phoenix, AZ	$452,300	2.4	$452,300	2.4	$458,200	2.4
Brawley, CA	50,300	0.2	50,300	0.2	51,000	0.2
Pasadena, CA	156,900	1.0	156,900	1.0	159,000	1.0
Weslaco, TX	173,400	0.5	173,400	0.5	175,700	0.5
Total	832,900	4.1	832,900	4.1	843,900	4.1

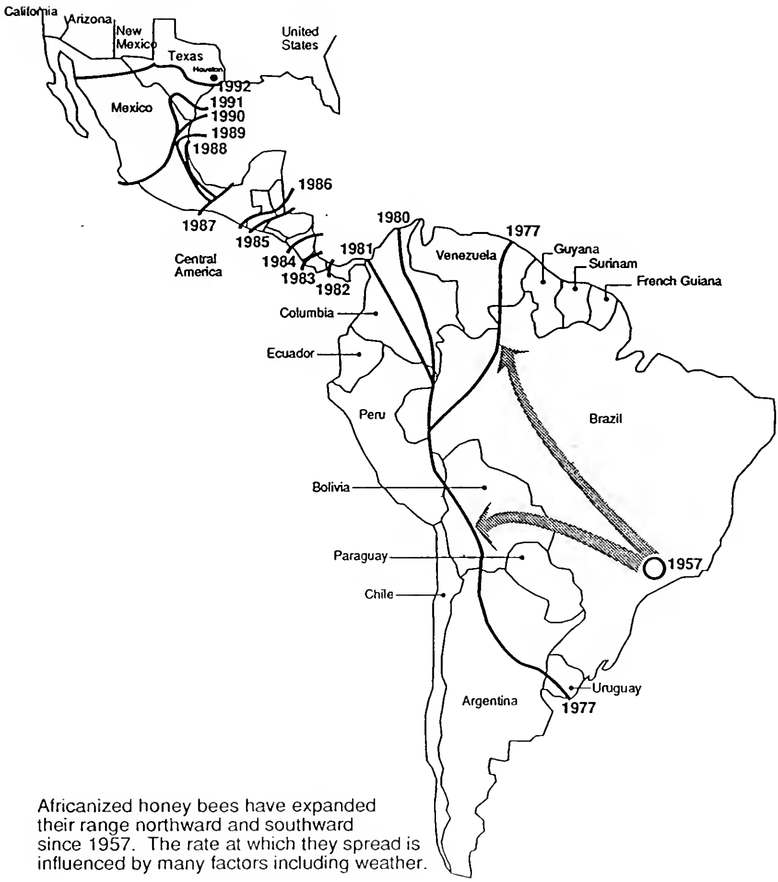
AFRICANIZED BEES

Mr. DURBIN. Would you please provide for the record a map similar to the one provided last year which shows the advance of the Africanized bee by year?

Dr. PLOWMAN. We will provide a map that shows South America, Central America, and the Southwestern United States and how the Africanized honey bee has advanced by year.

[The map follows:]

Migration of Africanized Honey Bees



Africanized honey bees have expanded their range northward and southward since 1957. The rate at which they spread is influenced by many factors including weather.

Mr. DURBIN. Would you please describe in detail the work you are doing in connection with Africanized bees?

Dr. PLOWMAN. ARS supports Department action and regulatory programs and addresses the beekeeping industry concerns about Africanized honey bees through research at four major laboratories. At the Honey Bee Breeding, Genetics, and Physiology Research Laboratory, Baton Rouge, Louisiana, emphasis is given to research on the genetic process of Africanization, to the development of barrier and control technologies, and to refinements in morphometric methods of identifying Africanized honey bees. At the Carl Hayden Bee Research Center, Tucson, Arizona, scientists are developing bait hive technologies with emphasis on arid environments and the evaluation of remote sensing technology as it may apply to Africanized honey bee surveillance. Scientists of the Honey Bee Research Laboratory, Weslaco, Texas, are conducting research on the management of European honey bees in areas of Africanization, on modifying the impact of Africanized honey bees on pollination of fruit and vegetable crops, and on the development of methods for personal protection from Africanized honey bees. Development and utilization of new techniques for Africanized honey bee identification are being pursued at the Bee Research Laboratory, Beltsville, Maryland. This laboratory also provides authoritative identification services and training for regulatory agencies.

WESLACO BEE LAB

Mr. DURBIN. When will the bee lab in Weslaco be completed?

Dr. PLOWMAN. Construction of the Weslaco bee lab should be completed in August 1993.

Mr. DURBIN. What research will be carried on there?

Dr. PLOWMAN. Research emphasis at the Honey Bee Laboratory, Weslaco, Texas, will focus on management of Africanized honey bees, characterizing population changes, reducing the negative impact of Africanized honey bees on pollination of fruit and vegetable crops, and developing means of personal protection from massive stinging attacks. In addition, research will emphasize developing the means of controlling parasitic mites with natural products, such as new formulations of menthol and formic acid, as well as alternative compounds.

Mr. DURBIN. What developments have occurred in the Africanized bee program during the past 12 months?

Dr. PLOWMAN. During the past 12 months, ARS scientists have established an Africanized honey bee apiary in South Texas in order to develop management techniques. New morphometric methods of Africanized honey bee identification have been developed specifically for populations in North America. In addition, methods of characterizing honey bees through DNA fingerprinting have been developed and are being applied to populations throughout the Southern and Western United States. Methods have been developed for queen breeders to reduce undesirable matings with Africanized honey bees by a techniques called drone flooding. A cooperative research effort to manage feral populations of Africanized honey bees in Big Bend National Park is underway.

Mr. DURBIN. Please provide for the record the funding assigned to the Africanized bee program by location.

Dr. PLOWMAN. During fiscal year 1993, funding for Africanized honey bee research at the four honey bee research locations is: Baton Rouge, Louisiana—$784,900; Tucson, Arizona—$374,500; Weslaco Texas—$362,000; and Beltsville, Maryland—$248,900. Total funds expended for Africanized honey bee research amount to $1,770,300, which is 44% of the total honey bee research effort.

ACARINE MITE

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with the acarine mite.

Dr. PLOWMAN. Research on the acarine mite continues to focus on selecting honey bee strains that are tolerant of acarine mite infestations. A strain of honey bees imported from Yugoslavia that has been evaluated and determined to be resistant to acarine mites, will be released to the beekeeeping industry in the spring of 1993. A strain of honey bees imported by ARS from England is nearing the final stages of evaluation for tolerance to acarine mites and is being evaluated by beekeeping industry cooperators in different geographical areas. In addition, research conti [illegible] on characterizing the biology and impact of acarine mites. Research is also conducted to develop both synthetic and natural plant product medications for acarine mite prevention and control.

Mr. DURBIN. Please provide for the record the funding and staff for acarine mite research for fiscal years 1992, 1993, and 1994.

Dr. PLOWMAN. The funding for acarine mite research was $1,058,400 in 1992, and is estimated to be $934,400 in 1993 and $946,700 in 1994. We have had 2.3 scientists in acarine mite research in each year.

VARROA MITE

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with the varroa mite.

Dr. PLOWMAN. ARS research scientists continue to evaluate the effectiveness of different honey bee strains for their tolerance to *Varroa* mite infestation. A honey bee strain imported by ARS from Yugoslavia has shown sufficient promise to be released to the beekeeping industry this spring. Research that employs genetic engineering technologies to develop new honey bee strains resistant to Varroa mites shows promise for the future. The feasibility of artificially rearing the mites away from honey bees is being determined in laboratory studies.

Mr. DURBIN. Please provide for the record the funding and staff for varroa mite research for fiscal years 1992, 1993, and 1994, by location.

Dr. PLOWMAN. We will provide the information for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Baton Rouge, LA	$28,400	0.1	$28,400	0.1	$28,800	0.1
Beltsville, MD	429,100	1.3	433,100	1.3	438,800	1.3
Total	457,500	1.4	461,500	1.4	467,600	1.4

HUMAN NUTRITION RESEARCH

Mr. DURBIN. Please describe for the record the funding for the human nutrition research facilities for fiscal years 1992, 1993, and 1994.

Dr. PLOWMAN. The funding and staff for each of the ARS Human Nutrition Research Centers for fiscal years 1992, 1993, and 1994 will be provided for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Beltsville, MD	$9,234.0	37	$9,227.9	36	$9,365.6	36
Grand Forks, ND	8,071.3	17	8,071.3	16	8,190.3	16
Boston, MA	14,568.1	35	14,568.1	35	14,571.8	35
Houston, TX	10,701.1	27	10,268.5	26	10,272.2	26
San Francisco, CA	5,114.6	16	5,114.6	15	5,185.3	15
Total	47,689.1	132	47,250.4	128	47,585.2	128

Mr. DURBIN. Please indicate for the record the funding and staff required for each of these facilities if they were operated at full capacity.

[The information follows:]

The funding and staff required for each of the Nutrition Centers if they were operated at full capacity are given in the following statements.

BELTSVILLE HUMAN NUTRITION RESEARCH CENTER, BELTSVILLE, MD

The total funding to operate the Center at a full capacity of 50 scientists is $19.6 million, requiring an increase of $10.3 million from current base funding.

Reaching full staffing and funding will allow generation of knowledge to better define the role of foods, and food components in prevention of nutritionally related disorders in the biochemically, culturally and aged diverse population. Specific areas of research activity impacted by the increase would include expanded cooperative research agreements with universities having specific expertise in these areas as well as: full staffing of the diet facility for human metabolic studies ($2.5M); development of standard methods for nutrient composition of foods and reference materials for validation of analysis ($3.5M); characterization of individual variation in energy balance related to diet ($1.5M); modeling and systems analysis approaches to study nutrient kinetics ($2.0M); and interactions of nutrients in foods ($0.8M).

GRAND FORKS HUMAN NUTRITION RESEARCH CENTER, GRAND FORKS, ND

The total funding to operate the Center at a full capacity of 24 scientists is $10.4 million, requiring an increase of $2.25 million from current base funding.

Full staffing and funding of the Center would allow expansion of knowledge on mineral requirements that will allow greater potential and optimal function throughout the life cycle and provide information for decisions concerning provision of a healthful food supply to the United States population. Specific areas of research impacted by an increase would be: effects of marginal or deficient trace element intake and status in adolescents and Native Americans on physiological and biochemical responses, cognitive functions, chronic diseases and adaptations to environ-

mental factors including airborne oxidants, chemical and ionizing radiation ($1.25M); and trace element requirements of elderly people and adolescents (especially during the adolescent growth spurt and during cyclic weight loss of the general population), and importance of trace element and magnesium nutriture in bone metabolism ($1.0M).

HUMAN NUTRITION RESEARCH CENTER ON AGING AT TUFTS UNIVERSITY, BOSTON, MA

The total funding to operate the Center at full capacity of 50 ARS and contract scientists at this ARS Government Owned Contractor Operated facility is $18.0 million, requiring an increase of $3.4 million from current base funding.

Full funding and staffing of the HNRC on Aging will provide support to gain needed information about safe and adequate nutrient intake and identify factors that may contribute to the degenerative processes associated with aging. Specific research areas impacted by an increase will be: interrelationships of diet (including antioxidants exposure), genetics and cell metabolism with immunological and other disorders of aging ($1.7M); and relationships of diet with maintenance of neurological and cognitive functions in aging. ($1.7M).

CHILDREN'S NUTRITION RESEARCH CENTER AT BAYLOR COLLEGE OF MEDICINE, HOUSTON, TX

The total funding to operate the Center at full capacity of 50 ARS and contract scientists at this facility operated under a General Cooperative Agreement is $16.0 million, requiring an increase of $5.75 million from current base funding.

Full funding and staffing at the Childrens HNRC will allow needed expansion of present active programs defining the nutritional needs of infants and young children. Increases in specific research areas include: energy and protein needs on growth, development and body composition of breast fed and formula fed infants ($1.5M); beneficial effects of human milk in host defense and on gastrointestinal function ($1.5M); regulation of cholesterol synthesis during lactation ($1.25M); and dietary factors regulating preborn and infant growth especially in adolescent mothers ($1.5M). A major portion of this expanded research activity will be performed through cooperative agreements with universities having expertise in these areas.

WESTERN HUMAN NUTRITION RESEARCH CENTER, SAN FRANCISCO, CA

The total funding to operate the Center at a full capacity of 30 scientists is $12.0 million, requiring an increase of $6.9 million from current base funding.

Full staffing and funding would allow expansion of present projects and initiation of studies in new areas directed towards meeting the WHNRC missions of developing knowledge on nutrient requirements and nutritional assessment methodology. Specific research areas of increased activity impacted by a budget increase would include: improving, evaluating, and implementing the computerized electronic approach to dietary assessment designed for independent use by lay subjects (U.S. Patent pending) ($1.4M); expansion of support services in areas of body composition, energy, metabolism and dietary assessment ($1.0M); establishing new research programs on diet and antioxidant metabolism ($1.0M); metabolism of dietary essential fatty acids in humans ($1.0M); and expanding present programs in diet and immunology and use of stable isotopes to study vitamin metabolism ($2.5M). Some of the expanded research activity will be performed through a cooperative agreement such as with the University of California.

Mr. DURBIN. Please describe for the record the type of research carried out at each of the five centers.

[The information follows:]

The type of research carried out at each of the ARS Human Nutrition Research Centers is as follows:

BELTSVILLE HUMAN NUTRITION RESEARCH CENTER, BELTSVILLE, MD

The role of foods and components in foods in optimizing health and reducing the risk of nutrition related chronic disorders, such as coronary heart disease, cancer and non-insulin dependent diabetes in the diverse population; composition of foods and bioavailability of food nutrients required by humans; energy metabolism and energy requirements for weight maintenance; human requirements and metabolic roles of carbohydrates and dietary fibers; and mineral vitamin interactions.

GRAND FORKS HUMAN NUTRITION RESEARCH CENTER, GRAND FORKS, ND

Nutritional requirements for zinc, magnesium, boron, copper, and other trace elements and their relationship to optimal health, function, and performance; and

physiological and biochemical factors influencing trace element requirements in all age groups and biological availability of minerals.

Human Nutrition Research Center on Aging at Tufts University, Boston, MA

Nutritional requirements of the elderly for optimal health, function, and performance; the relationship of nutrition to the aging process; role of diet in the prevention of chronic degenerative conditions; the role of diet in bone health, prevention of cataracts, and immune response; the interrelationships of exercise and diet on body composition; and the requirements and tolerances of the elderly for folacin, vitamin B-12, vitamin A, vitamin B-6, vitamin K, and antioxidant nutrients.

Children's Nutrition Research Center at Baylor College of Medicine, Houston, TX

Nutrient requirements of infants, children, pregnant, and lactating women; role of diet for optimum growth and physical and mental development—specifically, the use of stable nonradioactive isotopes as markers in studies related to energy, protein, fatty acid, carbohydrate, iron, and calcium requirements for growth of young infants and improved lactation in women; and nutritional needs of pregnant teenagers.

Western Human Nutrition Research Center, San Francisco, CA

Development of reliable, efficient, and inexpensive methods for defining nutritional status; effects of marginal nutrient levels on performance and immune function; development of nutritional criteria for evaluation of intervention programs; and human nutritional requirements, including omega-3 fatty acids, vitamin C, folacin, and molybdenum.

UNIVERSITY HUMAN NUTRITION RESEARCH

Mr. Durbin. For the record please describe the major research programs in the field of human nutrition carried out at various universities around the country.

Dr. Plowman. The major research programs in the field of human nutrition research at the various universities in the U.S. include those at land-grant institutions as well as medical schools. These include Cornell University, Ithaca, New York; University of California, Davis, California; Iowa, State University, Ames, Iowa; University of Illinois, Urbana, Illinois; Pennsylvania State University, University Park, Pennsylvania; University of Florida, Gainesville, Florida; Texas A & M University, College Station, Texas; and the University of Wisconsin, Madison, Wisconsin. Medical schools that have NIH-funded Clinical Nutrition Research Units are University of Chicago, University of California at Davis, University of Washington, Vanderbilt University, University of Alabama at Birmingham, Cornell University at New York City, Harbor-UCLA Medical Center, and Oregon Health Sciences Center. Columbia University has an NIH-funded Obesity Center, a Special Center of Research (SCOR) on arteriosclerosis, and a program on nutrition of low birth-weight infants. Obesity and Nutrition Research Centers are at the University of Vermont, Burlington, Vermont, New England Medical Center, Boston, Massachusetts, and the University of Pittsburgh, Pittsburgh, Pennsylvania. The University of California at San Diego and at San Francisco, the University of Chicago, and the University of Iowa also have SCOR programs on arteriosclerosis. The University of California at Berkeley has a program on child nutrition and chronic disease; the University of Texas Health Science Center at Dallas has a program of research on lipid metabolism; and Creighton University at Omaha, Nebraska, has a

SCOR program on osteoporosis. The Pennington Medical Center in Baton Rouge, Louisiana, has a nutrition research program associated with the Louisiana State University medical and nutrition programs.

USDA FUNDED HUMAN NUTRITION RESEARCH

Mr. DURBIN. Does USDA provide any funding for human nutrition research other than for the work at the five centers?

Dr. PLOWMAN. Yes. ARS supports a total of $2.47 million of human nutrition research in addition to its five Human Nutrition Research Centers. In fiscal year 1993, this will include $384,500 at the ARS Soil, Plant and Nutrition Laboratory, Ithaca, New York; $738,300 at the ARS National Center for Agricultural Utilization Research at Peoria, Illinois; $641,100 at the ARS Western Regional Research Center, Albany, California; and $710,800 at the ARS Family Economics Research Group. Hyattsville, Maryland. Other USDA agencies which have appropriated funds for human nutrition research in fiscal year 1993 include the Cooperative State Research Service, $12.5 million, including $3.8 million for competitive grants; Human Nutrition Information Service, $6.7 million; Economic Research Service, $1.1 million; and Food and Nutrition Service, $4.7 million.

IR-4 RESEARCH

Dr. PLOWMAN. The IR-4 program is a cooperative program among Federal, State, and industry scientists to register minor uses of pesticides. The major research component to develop performance and residue data is the joint responsibility of USDA-ARS, USDA-CSRS, the State agricultural experiment stations, and private industry. A staff headquartered at Rutgers University maintains files, tracks projects, prepares research protocols, and develops petitions for submittal to regulatory agencies and the chemical registrants. The program is guided by an Administrative Advisory Committee and a Technical Committee. I represent ARS on the Advisory Committee and one of our scientists is Chairman of the Technical Committee. In addition, the ARS role is to conduct field experiments for performance and residue data and laboratories to perform the residue analysis.

Mr. DURBIN. How are IR-4 projects selected?

Dr. PLOWMAN. Minor use needs are identified by growers, researchers and extension specialists. The researchable needs are prioritized at National IR-4 workshops. Annual selection of tentative projects are made at regional meetings by the IR-4 state and ARS liaison representatives. These selections are based in part on the priorities established by workshops and by regional and national needs. Final selection of projects is coordinated with the States and ARS and with the field and chemical residue studies at a national meeting each year. Availability of scientific expertise and resources to conduct the studies are the final determining factors in project selection.

IR–4 FUNDING

Mr. DURBIN. By location, what is the funding and staff for IR–4 research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. We will provide the levels of ARS funding and staff for IR–4 research for fiscal years 1992, 1993, and 1994 for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Salinas, CA	$141,700	1.1	$141,900	1.1	$141,900	1.1
Washington, DC	30,800		31,000		31,000	
Tifton, GA	626,000	2.6	649,400	2.6	649,400	2.6
Urbana, IL	10,300		10,300		10,300	
Beltsville, MD	312,500	1.6	343,200	1.6	343,200	1.6
Frederick, MD	47,400	.1	47,600	.1	47,600	.1
Poplarville, MS	11,400		11,400		11,400	.0
Wooster, OH	72,400	1.0	72,400	1.0	72,400	1.0
Corvallis, OR	62,000	.5	62,300	.5	62,300	.5
Charleston, SC	51,500	.2	51,800	.2	51,800	.2
Weslaco, TX	113,000	1.1	113,400	1.1	113,400	1.1
Prosser, WA	89,900	1.2	90,100	1.2	90,100	1.2
Yakima, WA	443,300	2.2	452,900	2.2	452,900	2.2
Held by headquarters	120,800	.1	64,200	.1	64,200	.1
Total	2,133,000	11.7	2,141,900	11.7	2,141,900	11.7

Mr. DURBIN. What is the total USDA budget for IR–4 for fiscal years 1992, 1993, and 1994, by agency?

Dr. PLOWMAN. The total USDA funding for IR–4 research for fiscal years 1992, 1993 and 1994 will be provided for the record.

[The information follows:]

Agency	Fiscal year 1992	Fiscal year 1993	Fiscal year 1994
ARS	$2,133,000	$2,141,900	$2,141,900
CSRS	4,420,000	4,446,000	11,145,000
Total	6,553,000	6,587,900	13,286,900

JOJOBA

Mr. DURBIN. Please describe for the Committee the research you are doing in connection with jojoba.

Dr. PLOWMAN. The oil portion of the jojoba seed is being utilized by the cosmetics industry. The high-cost of the oil makes it unacceptable as a raw material for most other industrial processes. In order to lower the overall cost of the seed products, the National Center for Agricultural Utilization Research—NCAUR—at Peoria, Illinois, has been developing uses for—the under-utilized seed meal, which makes up about 50 percent of the seed. NCAUR has recently developed a fermentation method of detoxifying the seed meal by inoculation with microorganisms. Another process uses the natural enzymes in the seed to destroy the toxins. These seed meals then can be used as a nutritious animal feed supple-

ment. Scientists at NCAUR have developed methods to isolate and characterize a unique low-molecular weight protein from jojoba meal. This protein can be used in shampoos as a foaming agent replacing other substances that the cosmetic industry finds objectionable. Scientists at NCAUR have isolated the natural toxicants from jojoba meal in an effort to find value-added uses for these biologically active compounds. Research is also underway to utilize the meal itself as an effective binder in pelletizing animal feed.

NCAUR is also cooperating with the jojoba industry to develop methods of analysis for some unique oil products.

Mr. DURBIN. What is the budget for this project for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The budget for this project was $143,600 for fiscal year 1992. The budgets for fiscal years 1993 and 1994 are $143,600 and $145,500, respectively.

KENAF

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with kenaf, by location.

Dr. PLOWMAN. We have research on kenaf at seven locations. The objectives of this research by locations will be provided for the record.

[The information follows:]

College Station, TX—Evaluation of the effect of nematodes on kenaf yields.

Lane, OK—Agronomic studies to evaluate the potential for kenaf in the High Plains area.

New Orleans, LA—Nonwoven process studies to refine methods of making kenaf mats for applications in forestry, garden care, carpet underlay and other potential uses.

Phoenix, AZ—Seed selection and breeding studies.

Stoneville, MS—Evaluation of optimum growth and harvesting management, processing the crop for its intended applications, product applications development, and improving the separation of kenaf into bast and core fiber.

Weslaco, TX—Germplasm evaluation, improvement of existing varieties, agronomic practices, and evaluation of disease and nematode resistance.

Headquarters—Product development, in support of the four small businesses processing kenaf, with a portion of funding to support the Fiber Cooperative of Tallahatchie County, Mississippi, by cooperative agreement through the TVA. Study of oil absorption for spill-cleanup, and water absorbency and retention to guide use of kenaf in applications such as sewage sludge and growth media under a cooperative agreement with the University of Houston. Use of kenaf products for greenhouse growth media and for chicken litter. The Forest Service Forest Products Laboratory, at Madison, Wisconsin, is working on resin composites, nonwoven mats for forest seedling protection and specialty paper applications.

Mr. DURBIN. By location, what is the funding and staff for kenaf research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The funding and staff for kenaf research by location for fiscal years 1992, 1993, and 1994 will be provided for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Headquarters	$222,200		$328,900		$262,900	
New Orleans, LA			43,300	0.2	110,700	0.5
Stoneville, MS	554,400		393,400		398,600	

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Lane, OK	151,400	1.0	151,400	1.0	153,400	1.0
College Station, TX	47,500	.3	48,900	.3		
Phoenix, AZ			22,300	.1		
Weslaco, TX	344,800	1.5	344,800	1.5	349,300	1.5
Total	1,320,300	2.8	1,333,000	3.1	1,274,900	3.0

LOCOWEED RESEARCH

Mr. DURBIN. Please describe for the Committee the work you are doing, by location, in connection with locoweed research.

Dr. PLOWMAN. ARS research on locoweed is conducted in Logan, Utah. Laboratory studies are determining the amount and duration of locoweed ingestion by livestock necessary to cause reproductive dysfunction, and evaluating the metabolic fate of the locoweed toxin, swainsonine, in animal tissues and the residues that may result. In sheep, ARS is evaluating the effect of locoweed poisoning on sheep and lamb behavior, and the progression and dose relationship of lesions. Grazing studies evaluate the effect of various environmental and pasture conditions on locoweed poisoning of cattle and sheep, and the relationship between the grazing experience of livestock and locoweed consumption. Management strategies to minimize locoweed poisoning and the potential for control with herbicides, or plant pathogen or native insect biocontrol agents are being studied through a cooperative agreement from the Logan laboratory with New Mexico State University.

Mr. DURBIN. Please describe the problems caused by locoweed.

Dr. PLOWMAN. Locoweed grows in all western states and is a serious problem in Utah, Arizona, New Mexico, Texas, Colorado, Wyoming, and Montana. The primary effects of locoweed on livestock include emaciation, neurological disturbances, abortions, birth defects, congestive right heart failure, decreased growth rate, decreased fertility, and loss of libido. If grazed extensively, animals may die and animals that survive are often useless for breeding or food.

Mr. DURBIN. By location, what is the funding and staff for locoweed research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The funding for locoweed research at Logan, Utah, was $516,357, in 1992. For fiscal years 1993 and 1994, funding is projected to be $516,357 and $523,136, respectively. We have 2 scientists working on locoweed research. This includes $114,000 in support of a cooperative agreement with New Mexico State University.

LOW-INPUT SUSTAINABLE AGRICULTURE

Mr. DURBIN. Would you please describe for the Committee in detail the work ARS has underway in the field of low-input sustainable agriculture.

Dr. PLOWMAN. ARS research on sustainable agriculture is broad based and encompasses about 20 percent of our programs. These projects that contribute to sustainable agriculture relate to one or

more of the following criteria: integrated system of plant and animal production practices, satisfy human food and fiber needs, enhance environmental quality, natural resource conservation and enhancement, biological resource utilization, economic viability, and quality of life. We will provide specific examples of ARS research related to sustainable agriculture in FY 1993 for the record.

[The information follows:]

The development of economically efficient and sustainable forage and livestock production systems for hill-land small farms.

The development and assessment of agroforestry systems for family farms that are compatible with combined livestock, tree, pasture, and wildlife production.

The development of new technology or knowledge to minimize production constraints of horticultural crops for small farms.

The determination of the effects of conservation tillage and reduced weed management on weeds, insects, diseases, crop yields, and soil quality in a 3-year cereal legume rotation.

The evaluation of insect pathogens and arthropods attacking selected insect and weed pests of solanaceous vegetables, cole crops, and sweet corn in the Mid-Atlantic region.

The evaluation of modern cultural practices (including conservation tillage, soil mulches, and plant covers) on the productivity of vegetable cultivars.

Mr. DURBIN. Where is this work carried out?

Dr. PLOWMAN. The first three of the examples given represent projects at Booneville, Arkansas. The fourth is an integrated pest management project at Pullman, Washington. The last two are projects from Beltsville, Maryland.

Mr. DURBIN. What is the budget for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. We reported earlier that about $120 million of ARS programs could be considered as contributing to sustainability in fiscal year 1992. For fiscal years 1993 and 1994, the estimates are $120 million and $121.6 million, respectively. However, we have recently reviewed new criteria, in conjunction with CSRS, for classifying sustainable agriculture research, as defined in the 1990 Farm Bill and have convened panels to reassess the contribution of individual research projects to sustainability. These panels include university scientists, representatives from industry, farmers, representatives from non-profit organizations, as well as USDA scientists. Upon completion, a new estimate of the contribution of ARS to sustainability can be provided. To date, 3 such panels have rated 691 projects out of a total of 1,500+ARS projects. Based on the results from these panels, projects totalling $68 million out of $232 million evaluated were judged to contribute significantly to sustainability, or 29 percent of the funds represented by those projects. The process of evaluating all ARS programs will be completed in April 1993.

LOW-INPUT FUNDING

Mr. DURBIN. What is the total USDA program, by agency, for low-input sustainable agriculture for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The total USDA funding for low-input sustainable agriculture by agency and fiscal year will be provided for the record.

[The information follows:]

SUSTAINABLE AGRICULTURE

[Dollars in thousands]

	Fiscal year 1992	Fiscal year 1993	Fiscal year 1994
Agricultural Research Service	$120,000	$120,000	$121,600
Cooperative State Research Service	90,459	90,559	91,952
Extension Service	37,600	37,600	37,600
Economic Research Service	215	215	215
Total	248,274	248,374	251,367

LYME DISEASE RESEARCH

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with Lyme disease research, by location.

Dr. PLOWMAN. The ARS program is currently being conducted at two laboratories. The Livestock Insects Laboratory, Beltsville, Maryland, conducts research on deer tick ecology at the woods/pasture interface as a risk factor and survival of adult ticks in various habitats. Scientists have also been assigned to evaluate methods to reduce population densities through integrated tick management and by the use of landscape barriers to constrain tick populations. A cooperative agreement has been developed with the New York Medical College, Valhalla, New York, with specific emphasis on the ecology and population dynamics of deer ticks on deer hosts and host/environment interactions. This research will effectively complement ongoing ARS research activities. The U.S. Livestock Insects Laboratory, Kerrville, Texas, is emphasizing the characterization of host/parasite interactions with particular attention to wildlife and the development of chemical control technologies, including medicated bait formulations, and their application within integrated management strategies.

Mr. DURBIN. By location, what is the funding and staff for Lyme disease research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The information follows will be provided for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Beltsville, MD	$406,700	1.0	[1] $406,700	1.0	[1] $412,400	1.0
Kerrville, TX	230,200	1.0	230,200	1.0	233,200	1.0
Total	636,900	2.0	636,900	2.0	645,600	2.0

[1] Includes $175,000 cooperative agreement with the New York Medical College.

MEADOWFOAM

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with meadowfoam research, by location.

Dr. PLOWMAN. Research in meadowfoam oil utilization is being done at The National Center for Agricultural Utilization Research at Peoria, Illinois—NCAUR. Scientists there are developing derivatives called estolides from the unique meadowfoam fatty acids as possible biodegradable lubricants. A patent application has been

made for the production of estolides. Meadowfoam fatty acids have been made into dimer acids and into amides. Both types of material have industrial applications in coatings, adhesives, and plastics. The oil itself has been converted into an excellent rubbery material called factice. This sulfurized oil product is superior to those currently on the market for use in hoses, printer rolls, and other molded rubber products. Scientists found that meadowfoam oil, mixed with other less expensive oils can make a factice almost of the same quality as the meeadowfoam factice itself. A patent application for this process has also been made. Work continues on other unique products from meadowfoam.

In addition to the utilization research, ARS is supporting research of Oregon State University in the genetics, breeding, and production of meadowfoam. Researchers at Oregon State University are concentrating on developing a self-pollinating variety of meadowfoam and registration of appropriate pesticides for this crop.

Mr. Durbin. By location, what is the funding and staff for meadowfoam research for fiscal years 1992, 1993, and 1994?

Dr. Plowman. ARS conducts meadowfoam research at Peoria, Illinois. This research amounted to $427,900 including 1 scientist in fiscal years 1992 and 1993, and $433,500 and 1 scientist in fiscal year 1994. Cooperative research with Oregon State University was supported through specified cooperative agreement from the funding allocated to Peoria in the amount of $162,690 in fiscal year 1992, and estimated $100,000 in fiscal year 1993. No funding is planned in fiscal year 1994.

MILKWEED

Mr. Durbin. Please describe for the Committee the work you are doing in connection with milkweed research, by location.

Dr. Plowman. ARS has no formal project dealing with milkweed as a crop. However, we have cooperated with the Nebraska milkweed industry in the characterization of the seed oil and evaluating the waxy material that covers the milkweed floss.

Mr. Durbin. By location, what is the funding and staff for milkweed research for fiscal years 1992, 1993, and 1994?

Dr. Plowman. ARS had no funds allocated to milkweed research in 1992, 1993, or planned for 1994. CSRS has funded research at the University of Nebraska in 1992 in the amount of $80,000. No funding is planned in 1993.

MUSHROOM RESEARCH

Mr. Durbin. Please describe for the Committee the work you are doing in connection with mushroom research by location.

Dr. Plowman. ARS conducts a limited amount of research on mushrooms at Albany, California. The research is directed toward development of synchronous growth of mushrooms to improve the efficiency of harvesting.

Mr. Durbin. By location, what is the funding and staff for mushroom research for fiscal years 1992, 1993, and 1994?

Dr. Plowman. Funding for mushroom research at Albany, California, in fiscal year 1992, was $143,700. For fiscal years 1993 and 1994, anticipated funding is $102,700 and $104,000, respectively. In each fiscal year, 0.4 scientists worked on mushroom projects.

MYCOPLASMA

Mr. DURBIN. Please describe for the Committee the work you have underway in Mycoplasma.

Dr. PLOWMAN. ARS is currently conducting Mycoplasma research at the South Central Poultry Research Unit, Mississippi State, Mississippi. The objectives of the research are to develop rapid diagnostic tests for mycoplasmosis in poultry and to identify methods to reduce poultry losses from morbidity, condemnation, and reduced production efficiency due to Mycoplasma infections. A rapid, flow cytometric technique has been developed using monoclonal antibodies for the diagnosis and strain differentiation of Mycoplasma infections in commercial chickens.

Mr. DURBIN. By location, what is the funding and staff for Mycoplasma research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The funding for Mycoplasma research in fiscal year 1992 was $303,600; the staffing was 1.5 scientists. For fiscal years 1993 and 1994, estimated funding is $303,600 and $307,600, respectively, with 1.5 scientific staff in each year.

NARCOTICS CONTROL RESEARCH

Mr. DURBIN. Please describe the work you have underway on narcotics control research.

Dr. PLOWMAN. ARS narcotics research primarily supports action and policy agencies. The primary among these are the White House Office of National Drug Control Policy, the Department of State, CIA, the Drug Enforcement Administration, and Federal public land agencies such as the Forest Service. Our primary research areas include illicit crop eradication research, crop substitution programs, narcotic crop identification by remote sensing, narcotic crop yield estimates, and narcotic plant biochemistry. Our long-term research goal is to establish an institutional capability to apply the principles of agricultural research and plant sciences to practical problems associated with illicit drug cultivation, processing, abuse, and associated activities. All our research efforts are coordinated on an interagency basis, under the aegis of the Service and Technology Committee of the Office of National Drug Control Policy on which the USDA is permanently represented.

Mr. DURBIN. By location, what is the funding and staff for narcotics research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The funding, by fiscal year, for narcotics research will be provided for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Beltsville, MD	$5,537,000	12.5	$5,527,000	12.5	$5,777,000	12.5
New Orleans, LA	200,000	.5	200,000	.5	100,000	.5
Stoneville, MS	450,000	3.0	460,000	3.0	300,000	2.0
College Sta, TX	300,000	1.0	300,000	2.0	310,000	2.0
Total	6,487,000	17.0	6,487,000	18.0	6,487,000	18.0

NATIONAL ARBORETUM

Mr. DURBIN. Please provide for the record the budget for the National Arboretum for fiscal years 1992, 1993, and 1994.

Dr. PLOWMAN. Funding for the National Arboretum for fiscal year 1992 was $4,353,700. For fiscal years 1993 and 1994, anticipated funding is $4,390,800 and $4,448,900, respectively. This includes funds used for repair and maintenance of buildings and facilities. The fiscal year 1993 Jobs Stimulus proposal includes $2 million for construction of the Arboretum's Waterline System.

NORTHWEST SMALL FRUIT RESEARCH CENTER

Mr. DURBIN. Please describe the work you are funding at the Northwest Small Fruit Research Center.

Dr. PLOWMAN. ARS conducts research on small fruits in the Northwest at Corvallis, Oregon. This research involves development of virus-free and virus-resistant small fruits, determination of the effects of beneficial soil microorganisms on small fruit plant growth and health, and evaluation of small fruit germplasm.

Mr. DURBIN. By location, what is the funding and staff for research at this Center for fiscal years 1992, 1993, and 1994.

Dr. PLOWMAN. Funding for research at the Northwest Small Fruit Research Center in Corvallis in fiscal year 1992 was $763,904. The funding in fiscal years 1993 and 1994 is estimated to be $710,678 and $721,200, respectively. We estimate that the number of scientists in each fiscal year is 2.4.

OATS RESEARCH

Mr. DURBIN. Please describe the work you have underway on oats research

Dr. PLOWMAN. We have research on oats at 15 locations. The objectives of this research by location will be provided for the record.

[The information follows:]

Aberdeen, ID—Preservation, evaluation and enhancement of germplasm.

Albany, CA—Molecular basis of gene expression and improved nutritional properties.

Ames, IA—Genetics of host resistance to rust.

Brookings, SD—Biological control of cereal aphids.

E. Lansing, MI—Understanding and improving winter hardiness.

Fargo, ND—Improving physical and chemical properties of oat brans.

Griffin, GA—Reducing rust losses.

Ithaca, NY—Influence of vectors on transmission of barley yellow dwarf virus.

Madison, WI—Physiological, biochemical and molecular regulation of quality.

Montpellier, France—Identification of natural enemies to the Russian wheat aphid.

Raleigh, NC—Resistance to fungal pathogens.

St. Paul, MN—Resistance to rust fungi.

University Park, PA—Genetic and physiological bases for freezing tolerance.

Urbana, IL—Mechanisms of resistance to cereal viruses.

W. Lafayette, IN—Biochemistry and genetics of disease resistance.

Mr. DURBIN. By location, what is the funding and staff for oats research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The funding and staff for oat research for fiscal years 1992, 1993, and 1994 will be provided for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Aberdeen, ID	$582,300	2.0	$618,300	2.0	$625,200	2.0
Albany, CA	178,800	.6	153,500	.6	155,600	.6
Ames, IA	165,600	.9	165,900	.9	168,100	.9
Brookings, SD	36,100	.2	36,100	.2	36,500	.2
E. Lansing, MI	15,000	.1	15,000	.1	15,200	.1
Fairbanks, AK	80,500	.4				
Fargo, ND	205,500	1.0	205,500	1.0	208,200	1.0
Griffin, GA	30,500	.2	30,500	.2	30,900	.2
Ithaca, NY	17,100	.1	17,100	.1	17,300	.1
Madison, WI	275,100	1.4	268,900	1.4	272,500	1.4
Montpellier, FR	91,200	.3	91,200	.3	92,400	.3
Raleigh, NC	27,100	.1	27,100	.1	27,500	.1
St. Paul, MN	414,600	2.3	414,900	2.3	420,500	2.3
Univ. Park, PA	184,800	1.0	184,800	1.0	187,200	1.0
Urbana, IL	81,100	.5	81,100	.5	82,200	.5
W. Lafayette, IN	145,700	.7	182,100	.7	184,600	.7
Total	2,531,000	11.8	2,492,000	11.4	2,523,900	11.4

PEACH RESEARCH

Mr. DURBIN. Please describe the work you have underway on peach research.

Dr. PLOWMAN. We will provide a description of research on peaches for the record.

[The information follows:]

ARS Headquarters—Staffing and funding for peach germplasm at the National Clonal Germplasm Repositories.

Booneville, AR—Production systems for small farms.

Albany, CA—Methods for detecting pesticide residues, control of toxic microbial metabolites, value-added products, and fruit processing.

Davis, CA—Control of fungal diseases, and germplasm maintenance and evaluation.

Fresno, CA—Biocontrol of insects, control of postharvest diseases, germplasm evaluation and enhancement, and variety development.

Athens, GA—Flavor and texture assessment, postharvest quality, and nondestructive measurements of fruit maturity.

Byron, GA—Biological control of ring nematode, identify low soil pH tolerant rootstocks, control of diseases and nematodes, development of improved pest-resistant varieties, and insect control.

Beltsville, MD—Detection and control of viruses and viroids, *in vitro* culture of endomycorrhyzae, gene transfer and tissue culture technologies, internal mechanisms of resistance to postharvest decay, and maintenance of quarantine facilities.

Lane, OK—Cultural and postharvest research relating to fruit quality and disease control.

Philadelphia, PA—Research on carbohydrate-based biopolymers.

Wenatchee, WA—Control of virus diseases.

Yakima, WA—Control of green peach aphid and other peach insects.

Kearneysville, WV—Breeding and variety development, peach fruit development and ripening, adaptation to biological and environmental stress, management of insect and disease pests, crop production using aquaculture effluent, mechanical harvesting, cultural practices, weed control, and postharvest quality.

Mr. DURBIN. By location, what is the funding and staff for peach research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. Funding and staff for peach research for fiscal years 1992, 1993, and 1994 will be provided for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Booneville, AR	$35,700	0.2	$22,800	0.2	$23,100	0.2
Albany, CA	224,900	.9	127,400	.8	129,100	.8
Davis, CA	125,600	.6	171,400	.7	173,700	.7
Fresno, CA	236,900	1.1	253,200	1.1	256,600	1.1
Athens, GA	507,700	2.0	337,600	2.0	342,100	2.0
Byron, GA	748,800	4.2	612,200	4.2	620,100	4.2
Beltsville, MD	622,500	2.8	622,900	2.8	631,300	2.8
Lane, OK	30,400	.2				
Philadelphia, PA	57,400	.3	59,600	.3	60,400	.3
Wenatchee, WA	59,400	.6	50,800	.6	51,500	.6
Yakima, WA	122,400	.6	71,800	.5	72,800	.5
Kearneysville, WV	1,460,100	7.7	1,670,300	7.7	1,692,000	7.7
Headquarters	4,400	.1	6,400	.1	6,400	.1
Total	4,236,200	21.0	4,006,400	21.0	4,059,100	21.0

PEANUT RESEARCH

Mr. DURBIN. Please describe the work you have underway on peanut research.

Dr. PLOWMAN. We have research on peanuts at 12 locations. The objectives of this research by location will be provided for the record.

[The information follows:]

Athens, GA—Methods to measure product composition and quality.

Beltsville, MD—Response mechanisms to drought and mineral stress and umbrella projects for research on aflatoxin and other food safety problems.

Dawson, GA—Development of new production systems.

Gainesville, FL—Bioregulation of stored product insects.

Griffin, GA—Maintenance, evaluation, and distribution of germplasm.

Mayaguez, PR—Germplasm development and seed increase.

New Orleans, LA—Genetic regulation of aflatoxin biosynthesis.

Raleigh, NC—Development of quality and flavor components.

Savannah, GA—Control of stored product insects.

Stillwater, OK—Evaluation of peanut germplasm.

Suffolk, VA—Improved germplasm to maximize production efficiency.

Tifton, GA—Improved management practices and improved peanut germplasm with improved resistance to disease, insects, and nematodes.

Mr. DURBIN. By location, what is the funding and staff for peanut research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The funding and staff for peanut research for fiscal years 1992, 1993, and 1994 will be provided for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Athens, GA	$81,300	0.5	$33,600	0.5	$34,000	0.5
Beltsville, MD	174,500	.4	130,100	.4	131,800	.4
Dawson, GA	2,329,800	10.0	2,328,700	10.0	2,359,400	10.0
Gainesville, FL	91,300	1.0	91,300	1.0	92,600	1.0
Griffin, GA	367,300	1.2	367,100	1.2	372,000	1.2
Mayaguez, PR	120,900	.5	120,800	.5	122,400	.5
New Orleans, LA	687,300	3.0	687,300	3.0	696,500	3.0
Raleigh, NC	763,400	4.0	762,900	4.0	773,100	4.0
Savannah, GA	388,300	2.0	388,200	2.0	393,400	2.0
Stillwater, OK	273,300	1.0	273,300	1.0	277,000	1.0

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Suffolk, VA	736,500	3.0	730,500	3.0	740,400	3.0
Tifton, GA	1,058,200	3.0	1,111,800	3.0	1,126,800	3.0
Headquarters	345,700		345,600		345,600	
Total:	7,417,800	29.6	7,371,200	29.6	7,465,000	29.6

PEAR THRIPS

Mr. DURBIN. Please describe the work you have underway on pear thrips.

Dr. PLOWMAN. ARS has provided insect pathology support and established a Specific Cooperative Agreement with the University of Vermont for the control of pear thrips. The ARS European Biological Control Laboratory at Montpellier, France, will provide logistical and laboratory support for a University of Vermont exploration team to try to locate biological controls for pear thrips.

Mr. DURBIN. By location, what is the funding and staff for pear thrips research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The funding at Ithaca, New York, for pear thrips in fiscal years 1992 and 1993 is $79,000. The estimated funding for fiscal year 1994 is $80,000. The scientist years are 0.3 for each year.

PEAS, LENTILS, AND LEGUMES

Mr. DURBIN. Please describe the work you have underway on peas, lentils, and legumes.

Dr. PLOWMAN. We have research on peas, lentils, and legumes at 7 locations. The objectives of this research by location will be provided for the record.

[The information follows:]

Albany, CA—Development of assays for pesticide residues on fresh peas and genetic engineering of ethylene response.

Athens, GA—Isolation and characterization of genes associated with flower development.

Beltsville, MD—Photosynthesis research on fresh peas.

Geneva, NY—Germplasm maintenance and evaluation of fresh and dry peas.

Prosser, WA—Germplasm evaluation and enhancement of peas, disease resistance, and computer modeling of conservation tillage-based production systems.

Pullman, WA—Insect and disease resistance in dry peas and lentils; establish genetic linkage maps in lentils, dry peas, and chickpeas; and variety development and integrated pest management of legume crops.

Mr. DURBIN. By location, what is the funding and staff for peas, lentils, and legumes research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The funding and staff for peas, lentils, and legumes research for fiscal years 1992, 1993, and 1994 will be provided for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Albany, CA	249,400	1.1	145,300	1.1	147,300	1.1
Athens, GA	19,200	.1	19,200	.1	19,500	.1
Beltsville, MD	138,500	.6	138,500	.6	140,300	.6

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Geneva, NY	66,900	.3	66,900	.3	67,800	.3
Prosser, WA	186,800	1.0	186,800	1.0	189,200	1.0
Pullman, WA	425,100	2.0	425,100	2.0	430,800	2.0
Headquarters	65,100	.3	65,100	.3	65,100	.3
Total	1,151,000	5.4	1,046,900	5.4	1,060,000	5.4

PECAN APHID

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with pecan aphid research, by location.

Dr. PLOWMAN. The research we are doing in pecan aphids includes biological and chemical control and integrated pest management studies at Byron, Georgia, and host plant resistance studies at Stoneville, Mississippi.

Mr. DURBIN. By location, what is the funding and staff for pecan aphid research for fiscal years 1992, 1993 and 1994?

Dr. PLOWMAN. I will provide the requested information for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Byron, GA	$394,500	2.2	$394,500	2.2	$399,700	2.2
Stoneville, MS	46,900	.3	46,900	.3	47,500	.3
Total	441,400	2.5	441,400	2.5	447,200	2.5

PLANT GENE EXPRESSION CENTER

Mr. DURBIN. Please describe for the Committee some of the accomplishments of the Plant Gene Expression Center during the past 12 months.

Dr. PLOWMAN. Some of the accomplishments of the Plant Gene Expression Center for the past 12 months are as follows:

Fertile transgenic barley plants containing an antiviral gene for the barley yellow dwarf virus—BYDV—have been made. The Small Grains Consortium of the Plant Gene Expression Center has developed a reproducible and efficient transformation system for barley. Three genes were used in the transformation experiments—a selectable gene, a screenable gene, and a gene for BYDV resistance. In excess of seventy independent transformation events from three different barley genotypes have been generated. The presence of the antiviral gene has been confirmed in this tissue. Over 500 transgenic barley plants from two public lines, one spring and one winter variety, have been regenerated from this tissue and the plants have set seed. The presence of the introduced reporter gene has been confirmed in second generation plants by their ability to grow in the presence of the selective agent. The antiviral constructs were generated from genes provided by collaborators at

Washington State University and Purdue University. Transgenic second generation barley will be challenged by these collaborators with BYDV-infected aphids. Field testing of these materials is planned. The third barley variety used in the transformation experiments is a privately held, spring variety and transformed tissue from this genotype is presently in regeneration. Transformation experiments with BYDV antiviral constructs is currently underway with a fourth genotype.

When crop plants are grown in dense stands, they respond by growing taller than they otherwise would. This behavior diverts energy and nutrients into vegetative stem growth that would otherwise be available for harvestable plant parts such as fruit or seeds. The Plant Gene Expression Center has demonstrated that a specific photoreceptor, phytochrome B, is responsible for this behavior by allowing the plant to sense the presence of neighboring competitors in close proximity and signaling the plant to grow tall more rapidly to out compete its neighbors. This information provides the opportunity through genetic engineering methods targeted at the phytochrome system to selectively disarm the neighbor perception mechanism and thus reduce the diversion of nutrients into nonharvestable plant parts. Scientists have begun a collaborative project to test this strategy in potatoes where success would be reflected in higher tuber yields.

Although grass family crops, including maize, rice and wheat, have now been transformed and fertile transgenic plants produced, the efficiency of the technology remains low. One of the main reasons for this situation is that the promoter used to drive the selectable marker in the majority of studies, the 35S CaMV promoter, has relatively weak activity in grasses. To circumvent this problem, our scientists isolated the promoter for the ubiquitin gene (UBI–1) from maize and showed that it is 15 to 20 times stronger than the 35S promoter in grass cells. Subsequently, we used the UBI–1 promoter fused to the bar gene selectable marker to generate fertile, transgenic rice plants which express the marker gene at high levels. We have now distributed UBI promoter constructs to about 50 laboratories for use in the production of transgenic maize, barley, wheat, sugar cane, and rice.

Three U.S. companies have been exclusively licensed to develop independent product lines of commercial "vine-ripe" tomatoes. Using technology developed at the Plant Gene Expression Center, reverse DNA coding ethylene message, the natural production of ethylene, is inhibited in these green tomatoes. They will grow but will remain healthy for an extended period of time. These tomatoes never turn red or soften until they are exposed to ethylene gas, a natural ripening agent, where they ripen normally producing high-quality fruits in 10–15 days. The transfer of ARS technology to these commercial companies will allow them to create markets through a network of producers and packers who can select the time of ripening and thereby reduce spoilage and provide consumers with high-quality, table-ripened tomatoes. Other commercial groups have licensed the technology for development in other vegetable and fruit crops as well as for a broad range of cut flowers.

Mr. Durbin. What is the budget for the Center for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The budget for the Center for fiscal year 1992 was $3,119,000. For fiscal years 1993 and 1994, the budgets are estimated to be $3,136,700 and $3,178,385, respectively.

POTATO RESEARCH

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with potato research by location.

Dr. PLOWMAN. A description of ARS potato research programs by location will be provided for the record.

[The information follows:]

ARS Headquarters—Funds maintained at headquarters are allocated for extramural research on ring rot, early dying and scab disease problems, aphid and beetle control, marketing, and variety development.

Albany, CA (PGEC)—Development of new genetic engineering techniques and gene expression of economically important genes of potato.

Albany, CA (WRRC)—Improved potato quality using plant cell transformation and other genetic engineering techniques.

Athens, GA—Nondestructive measurement of potato quality.

Aberdeen, ID—Development of new improved pest resistant varieties and disease management strategies.

Peoria, IL—Identification and chemical mode of action of potato sprout inhibitors.

Orono, ME—Control of potato diseases and nematodes, develop integrated pest management strategies, and determine effect of soil and water stress on potato production.

Beltsville, MD—Germplasm evaluation, gene enhancement, and breeding improved varieties; protoplast fusion and other genetic engineering techniques; processing germplasm introductions; pathogen-host interactions and genetics of resistance; and biological control of potato insects. Field trials in support of the breeding program are at Presque Isle, Maine.

Frederick, MD—Research on exotic fungal pathogens of potato including methods of detection and control.

East Grand Forks, MN—Physical properties and other factors associated with processed potato quality, volatiles and prediction of potato quality from bulk storage, processing quality factors of potatoes following storage, evaluation of potential new varieties for processing attributes, and inhibition of sprouting.

Fargo, ND—Marketing, storage, and inhibition of sprouting.

Ithaca, NY—Evaluation of potato germplasm for nematode resistance, biology and control of golden nematode, and biological control mechanisms for potato diseases.

Wooster, OH—Management of potato insects.

Philadelphia, PA—Biochemical and ultrastructural features of interaction of potato pathogens with host plant, mycotoxin production in plants, and improved food processing methods for potatoes.

Prosser, WA—Evaluation and enhancement of potato germplasm including use of genetic engineering techniques, development of new improved varieties, and methods of disease control.

Yakima, WA—Insect behavior, insect ecology, biological control, and improved methods of pest control of potato insects.

Madison, WI—Classification, evaluation, preservation, and distribution of introduced germplasm; potato genetics and cytogenetics; and protoplast fusion and other genetic engineering techniques.

Mr. DURBIN. By location, what is the funding and staff for potato research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. We will provide ARS funding and staff years on potato research by location and fiscal years are for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Albany, CA (PGEC)	$197,500	1.0	$232,500	1.0	$235,600	1.0
Albany, CA (WRRC)	980,100	4.7	1,300,400	4.7	1,317,900	1.0

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Athens, GA	35,000	.2	35,000	.2	35,400	.2
Aberdeen, ID	334,000	1.5	389,400	1.5	394,700	1.5
Peoria, IL	242,000	1.0	258,500	1.0	262,000	1.0
Orono, ME	593,400	2.8	592,900	2.8	600,900	2.8
Beltsville, MD	2,742,200	12.5	3,148,700	12.5	3,191,000	12.5
Frederick, MD	58,700	.3	58,800	.3	59,600	.3
E. Grand Forks, MN	1,061,000	5.4	1,061,000	5.4	1,075,200	5.4
Fargo, ND	285,900	1.3	285,900	1.3	289,700	1.3
Ithaca, NY	270,300	1.2	270,300	1.2	274,000	1.2
Wooster, OH	24,300	.1	24,300	.1	24,700	.1
Philadelphia, PA	153,200	.6	153,200	.6	155,300	.6
Prosser, WA	1,043,200	5.1	1,024,900	5.1	1,038,700	5.1
Yakima, WA	773,300	3.5	803,200	3.5	814,000	3.5
Madison, WI	570,000	2.8	619,100	2.8	627,400	2.8
ARS Headquarters[1]	1,684,000		1,422,900		1,422,900	
Total	11,048,100	44.0	11,681,000	44.0	11,819,000	44.0

[1] Funds provided for cooperative research to the following States: Idaho, Massachusetts, Maryland, Michigan, Minnesota, North Carolina, North Dakota, New York, Ohio, Oregon, Pennsylvania, Virginia, Washington, Wisconsin, and Wyoming.

Mr. DURBIN. Please provide for the record a table showing the research funding devoted to ring rot, early dying, marketing, aphids, potato beetle, weeds, variety development, soils, and agricultural engineering for fiscal years 1992, 1993, and 1994.

Dr. PLOWMAN. The information by type of research by fiscal year will be provided for the record.

[The information follows:]

	FY 1992	FY 1993	FY 1994
Ring Rot	$559,600	$470,000	$472,400
Early Dying	538,600	911,600	920,200
Marketing	2,839,000	2,221,900	2,251,100
Aphids	399,800	464,900	467,000
Potato beetle	1,107,800	1,439,100	1,450,000
Weeds			
Variety development	1,769,200	1,894,900	1,916,400
Soils	244,900	236,800	239,900
Agricultural engineering	330,100	336,800	341,200
Total	7,789,000	7,976,000	8,058,200

RUSSIAN WHEAT APHID

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with the Russian wheat aphid, by location.

Dr. PLOWMAN. The research objectives on Russian wheat aphid by location will be provided for the record.

[The information follows:]

Beltsville, MD—Develop predictive classification for the identification and control of aphids. The Beltsville laboratory is also participating in an international program for the control of Russian wheat aphids.

Brookings, SD—Determine the effect of stress caused by aphid feeding on quality of cereal plants.

Columbia, MO—Genetically characterize parasitoids of the wheat aphid.

Ithaca, NY—Investigate fungal insect pathogens for the control of aphids.

Manhattan, KS—Develop wheat resistant populations to aphids through use of genetic manipulation.

Montpellier, France—Discover, collect and determine usefulness of parasites, predators and pathogens of the Russian wheat aphid from Europe and the Near East.

Newark, DE—Evaluate exotic predators of Russian wheat aphid under quarantine conditions.

Stillwater, OK—Identify and characterize genotypes in cultivated and related wheat and barley species that are resistant to Russian wheat aphid and release resistant cereal germplasm to breeders. Rear, release, and evaluate natural enemies of the Russian wheat aphid for the control of this insect pest.

Mr. DURBIN. By location, what is the funding and staff for Russian wheat aphid research for fiscal years 1992, 1993 and 1994?

Dr. PLOWMAN. The information will be provided for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Newark, DE	$34,200	0.2	$34,200	0.2	$34,600	0.2
Manhattan, KS	79,300	.4	79,300	.4	80,300	.4
Beltsville, MD	45,400		44,400		45,000	
Columbia, MO	62,000	.3	62,000	.3	62,800	.3
Itahaca, NY	263,800	1.0	263,800	1.0	267,300	1.0
Stillwater, OK	1,218,800	5.0	1,431,200	5.0	1,450,000	5.0
Brookings, SD	153,700	1.0	134,200	1.0	136,000	1.0
Montpellier, France	456,000	1.0	456,000	1.0	462,000	1.0
Headquarters (NPS)	111,100	.6				
Total RWA	2,424,300	9.5	2,505,100	8.9	2,538,000	8.9

SOYBEAN-BASED INK

Mr. DURBIN. What have been the developments with regard to the commercial use of soybean ink during the past year?

Dr. PLOWMAN. The work performed at the ARS National Center for Agricultural Utilization Research—NCAUR—to develop the technology for improved, cost competitive offset newspaper ink consisting of 100 percent modified vegetable oil and pigments is patented and available for license. ARS is working to transfer this technology which has the potential of expanding the current use of soybean oil in the news ink market from about 30 million to 500 million pounds.

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with soybean-based ink, by location.

Dr. PLOWMAN. At the National Center for Agricultural Utilization Research—NCAUR, Peoria, IL, we are evaluating the biodegradation of our offset news inks and for comparison, biodegradation of commercial inks. Significant progress is being made in developing three additional ink technologies representing heat-set which is intended for use with slick, high clay content paper; sheet fed for printing book-type papers that might be lightly coated, surface-sized, or calendered; and water-based flexographic news ink. ARS works with Lehigh University to mill the heat-set ink formulations and evaluate their drying characteristics. The objective of the ARS ink research is to develop for each application technologies consisting of substantial soybean oil content and without volatile organic compounds.

Mr. DURBIN. By location, what is the funding and staff for soybean-based ink research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The Agricultural Research Service funding for fiscal years 1992 and 1993 for soybean-based ink research at the National Center for Agricultural Utilization Research, Peoria, Illinois, is $509,600. This funding also supports a cooperative research agreement with Lehigh University in the amount of $124,000. In fiscal year 1994, the funding is estimated to be $516,300. The scientists supporting this project remain at 1.2 in fiscal years 1992, 1993, and 1994.

STEEP II RESEARCH

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with STEEP II research, by location.

Dr. PLOWMAN. Two ARS locations are doing research in connection with STEEP II.

At Pendleton, Oregon, we design soil, water, and crop management systems which maintain or improve soil productivity, safeguard water quality, and enhance net returns to farmers. We also quantify the impact of conservation cropping systems on runoff, wind and water erosion, and on surface and ground water quality. ARS scientists develop computer models and expert systems to predict the impact of farm conservation management options on runoff, erosion, and quality of surface and groundwater.

At Pullman, Washington, ARS scientists development combinations of tillage, crops, residue management, nutrient treatment, and weed and other pest control systems to control wind and water erosion, enhance water quality, and increase farm profitability. We also have research to quantify the impact of conservation cropping systems and alternative management practices on runoff, and wind and water erosion.

Mr. DURBIN. By location, what is the funding and staff for STEEP II research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The funding and staff for STEEP II research for fiscal years 1992, 1993, and 1994 will be provided for the record.

[The information follow:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Fullman, WA	$188,600	1.2	$188.600	1.2	$191,100	1.2
Pendleton, OR	464,100	2.9	464,100	2.9	$470,200	2.9
Total	652,700	4.1	652,700	4.1	661,300	4.1

SULFUR DIOXIDE ON TABLE GRAPES

Mr. DURBIN. Please describe for the Committee the work you have underway on the use and residue of commercial sulfur dioxide on table grapes. Where is this work being carried out and what are you doing?

Dr. PLOWMAN. The research on both the use and the residues of commercial sulfur dioxide on table grapes is being carried out at the USDA Horticultural Crops Research Laboratory, Fresno, Cali-

fornia, in cooperation with the University of California-Davis, Fresno State University and the Table Grape Commission. This work has resulted in a 50 percent annual reduction in the releases to the environment from sulfur dioxide used on grapes in California compared to 1987. ARS research is also determining the minimum sulfur dioxide doses required for control of postharvest decay and measuring the accumulation and persistence of sulfites in grapes. In fiscal year 1992, the Fresno laboratory published an industry manual for grape fumigation and the modified recommendations are being used by the industry. A rapid colorimetric analytical method for sulfite was refined and compared to current established methods. In fiscal year 1993, the Fresno laboratory will continue the long-term sulfite residue studies. Also, more industry confirmatory tests are being discussed, particularly for grapes destined for trans-Pacific markets.

Mr. DURBIN. By location, please indicate the dollars and staff years devoted to this research in fiscal years 1992, 1993, and 1994.

Dr. PLOWMAN. The dollars and staff years devoted to this research remained unchanged during fiscal years 1992 and 1993 at $77,500 and supported .5 scientist each year. In fiscal year 1994, the estimated funding will be $78,500 and continue to be supported by .5 scientists.

SWEETPOTATO WHITEFLY

Mr. DURBIN. Please describe for the Committee the work you have underway on sweetpotato whitefly.

Dr. PLOWMAN. The research objectives to solve the sweetpotato whitefly—SPW—problem include the development and evaluation of naturally occurring growth regulators, investigation of the correlations between SPW and irregular ripening in tomatoes and silver leaf in squash, development of IPM systems for cropping systems in the southeast, and the development of a naturally occurring pesticide from Nicotiana plant. We also conduct research on development of management systems for greenhouse and nursery crops; greenhouse and field evaluations of new pesticides and application technology; evaluation of insect-specific fungi for control of SPW; exploration, introduction and evaluation of exotic biocontrol agents; and investigation of virus-vector relationships and effects of naturally occurring plant virus reservoirs on the incidence of viral disease. We are expanding research on the identification and evaluation of naturally occurring predators, development of techniques for mass production, evaluation of the biological characteristics of the B-biotype of SPW, development of IPM approaches for the SPW in desert southwest cropping systems, and evaluation of the SPW as a pest of peanuts and the development of management and control technologies.

The ARS redirected approximately $850,000 in base funds in fiscal year 1993 from less critical research on other insect pests to fund their expanded research program on the SPW.

Mr. DURBIN. What developments have occurred during the past year?

Dr. PLOWMAN. ARS provided the leadership for the development and coordination of a 5-Year National Research and Action Plan

for sweetpotato whitefly—SPW—that includes 15 SAES and other agencies. The first annual review of research activities in support of this plan was held in January 1993. A USDA SPW Research, Education, and Action Coordinating Group was organized with representatives from ARS, CSRS, APHIS, SAES, and CES serving as members. This group is chaired by ARS and its purpose is to coordinate SPW research activities and to keep Departmental officials appraised of the current SPW situation. ARS scientists in Beltsville discovered, identified, and successfully field tested a biorational material from *Nicotiana* species that is highly effective against SPW nymphs as well as aphids, spider mites and psylla. ARS closely cooperated with industry and the Environmental Protection Agency to develop the necessary data for the eventual registration of new and highly effective insecticides. Data indicates that NTN 33893, a new unregistered pesticide, can provide up to 60 days protection of young plants following soil applications.

ARS scientists at Orlando, Florida, discovered the chemical that SPW injects into plants which causes the condition known as "silver leaf". They have also identified chemicals which can partially reverse this condition. ARS collaborated with SAES in Florida, Texas, California, Georgia, and Mississippi to conduct field evaluations of insecticides and application technology for SPW control. Two effective insecticides, Capture and Thiodan, were effective against SPW good plant coverage was obtained. ARS accelerated foreign explorations for potential biocontrol agents and more than 40 exotic parasites and predators and 12 insect specific pathogens have been shipped to quarantine facilities in the United States for eventual field evaluation. A new species of an insect-specific fungi was discovered by ARS scientists in Texas. The fungi reached epidemic proportions in SPW populations in the Rio Grande valley of Texas in the Fall of 1992. ARS scientists found that in the absence of pesticides, endemic parasites can reduce SPW up to 90 percent. ARS scientists at Phoenix, Arizona, determined that cultural practices such as host-free periods, appropriate crop sequencing, and irrigation are quite useful in management programs for this pest.

Mr. DURBIN. By location, what is the funding and staff for sweetpotato whitefly research for fiscal years 1992, 1993 and 1994?

Dr. PLOWMAN. The information will be provided for the record.

[The information follows:]

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Phoenix, AZ	$468,500	2.3	$485,100	2.3	$491,500	3.3
Albany, CA			56,800	.3	57,500	.3
Salinas, CA	32,800	.1	36,400	.1	36,900	.1
Newark, DE	68,500	.3	34,200	.3	34,600	.3
Orlando, FL	132,700	.6	122,400	.6	124,000	.6
Tifton, GA	58,900	.3	73,900	.3	74,900	.3
Beltsville, MD	75,000	.4	286,800	1.4	290,600	1.4
Ithaca, NY			87,900	.3	89,100	.3
Fargo, ND			205,900	1.0	208,600	1.0
Charleston, SC			233,200	1.0	236,300	1.0
Weslaco, TX	477,800	2.4	584,300	2.4	592,000	2.4
Montpellier, France	151,300	.6	108,100	.6	109,500	.6

Location	Fiscal year 1992		Fiscal year 1993		Fiscal year 1994	
	Funds	Scientists	Funds	Scientists	Funds	Scientists
Total SPW	1,465,500	7.0	2,315,000	11.6	2,345,500	11.6

TAXOL RESEARCH

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with taxol research by location.

Dr. PLOWMAN. In 1991, ARS patented a plant culture system from yew tree bark which provides taxol yields equivalent to natural bark, 0.01 to 0.02 percent. The process defines media and supplements needed for induction, cell growth, and taxol enhancement. In early 1992, the National Cancer Institute provided a 5-year grant of $300,000 to optimize a bioreactor system for taxol cell culture production to a consortium of Phyton Catalytic, Inc., Cornell University, and ARS. ARS also collaborated with Ohio State in the modification of a small combine header to provide a mechanized "taxus clipping combine"used to collect nursery stock clippings.

In other research, ARS developed a method for isolating a crude mixture of taxanes from yew needles as a dry powder with 2–3 percent taxanes and 0.5 percent taxol. Additionally, methods were developed for quantitative taxol analysis and screening of crude cell culture extracts and taxus germplasm for taxanes.

ARS will sponsor a plant exploration in the late spring of 1993 to acquire germplasm of a little known yew species which may provide a more economical source of taxol than current sources.

Mr. DURBIN. By location, what is the funding and staff for taxol research, for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The funding for taxol research for fiscal year 1992 was $146,500. In fiscal years 1993 and 1994, the funding will be $46,500 and $51,295, respectively. The staff years are .2 for each year.

TROPICAL/SUBTROPICAL RESEARCH

Mr. DURBIN. Please describe for the Committee the tropical and subtropical research being carried on under Section 406 of the Agricultural Trade and Development Assistance Act.

Dr. PLOWMAN. We are conducting tropical and subtropical research in Hawaii and Puerto Rico under Section 406 of the Agricultural Trade and Development Assistance Act. In Hawaii, our research programs relate to postharvest quarantine treatments which will help with export of tropical fruit crops grown in the Pacific Basin. In Puerto Rico, we have research programs on production and marketing of certain horticultural and forage crops. Emphasis is placed on evaluation of new crop varieties and species through to have economic potential for development of cultural and management practices for specific crops in the Caribbean Basin. Emphasis is placed on fruit crops, vegetables, cereal crops, coffee, cacao, and tannier and other root crops. We also have educational programs where individuals receive training on production and marketing of individual crops. These specialists then return to

their farming communities and production areas to help train others in tropical/subtropical agriculture.

Mr. DURBIN. By location what is the budget for this research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The budget for this research for fiscal years 1992, 1993, and 1994 will be provided for the record.

[The information follows:]

Location	Fiscal year 1992	Fiscal year 1993	Fiscal year 1994
Honolulu, HI	$164,300	$164,300	$166,500
Mayaguez, PR	670,400	670,400	679,200
Total	834,700	834,700	845,700

TURKEY OSTEOMYELITIS

Mr. DURBIN. Please describe for the Committee the work you are doing in connection with turkey osteomyelitis, by location.

Dr. PLOWMAN. The ARS research program on leg problems or diseases in turkeys and other poultry was initiated in fiscal year 1991 at the Poultry Production and Products Safety Research Laboratory in Fayetteville, Arkansas. The objectives of the program are to identify the causes, to define the disease processes, and to develop methods to treat or prevent these diseases in commercially produced turkey poults and other poultry. Staffing and facility renovation for the program have been completed. Current studies are being conducted to determine when leg problems or diseases occur in the production cycle, to correlate isolation of microorganisms with signs of disease, and to relate diseases to various production practices.

Mr. DURBIN. Please describe the problem.

Dr. PLOWMAN. The commercial poultry industry has identified an economically significant occurrence of leg problems or diseases of unknown origin in turkey poults and other poultry during commercial production. These problems include osteomyelitis, which is infectious inflammation of the bones; tibial dyschondroplasia, or abnormal cartilage growth at the ends of the leg bone; and synovitis, which is infectious inflammation of the membranous lining of the joints in turkeys. Frequently, these diseases are associated with undesirable discoloration of the livers of affected poultry and may lead to condemnation and other production losses.

Mr. DURBIN. By location, what is the funding and staff for turkey osteomyelitis research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The funding and staff for turkey osteomyelitis research during fiscal years 1992 and 1993 were $403,100 and 2.0 scientists, respectively, each year. In 1994, the estimated funding will be $408,400 and the staffing will continue to be 2.0 scientists. The turkey osteomyelitis program is located at Fayetteville, Arkansas.

URBAN PEST RESEARCH

Mr. DURBIN. Please describe the work you have underway on urban pest research. Last year Congress provided additional funds for urban pest research. How are these funds being used?

Dr. PLOWMAN. Urban pest research emphasizes investigations for developing means for controlling cockroaches, fleas, and pest ants in the urban environment. Special attention is given to strategies for controlling resistant populations of cockroaches and fleas through the use of new technologies such as toxicant baits, repellents for selective use, and growth inhibitors. Integrated management strategies are being developed for control of domestic and peridomestic cockroaches and fleas with the specific objective to reduce exposure of people to pesticides in the urban environment. Research on pest ant control also emphasizes selective utilization of toxicants through new bait and repellent technologies within an integrated pest management framework.

Mr. DURBIN. By location, what is the funding for urban pest research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. All ARS urban pest research is conducted at the Imported Fire Ant and Household Insects Research Unit, Medical and Veterinary Entomology Research Laboratory, Gainesville, Florida.

In fiscal years 1992 and 1993, funding was $813,700. In fiscal year 1994, funding is estimated to be $824,300. Funds include $122,926 for cooperative research on Formosan termites at the University of Hawaii.

STAFFING RESEARCH FACILITIES

Mr. DURBIN. Would you please provide for the record a table indicating, by location, your total laboratory capacity in terms of the number of scientists, indicating the total number of scientists assigned to that facility and the percent staffed?

Dr. PLOWMAN. The laboratory capacity, the number of scientists assigned by location and the percent staffed will be provided for the record.

[The information follows:]

STATUS OF STAFFING OF AGRICULTURAL RESEARCH SERVICE FACILITIES AS OF OCT. 31, 1992

[Expressed in terms of scientific personnel]

Location	Total capacity scientist	Total in use scientist	Percent staffed
Alabama: Auburn	13	10	77
Arizona:			
Phoenix	41	30	73
Tucson	34	34	100
Arkansas: Booneville	12	10	83
California:			
Albany	189	140	74
Davis	10	4	40
Fresno	31	26	84
Pasadena	26	19	73
Riverside	30	30	100
Salinas	14	13	93
San Francisco	31	31	100

STATUS OF STAFFING OF AGRICULTURAL RESEARCH SERVICE FACILITIES AS OF OCT. 31, 1992—Continued

[Expressed in terms of scientific personnel]

Location	Total capacity scientist	Total in use scientist	Percent staffed
Colorado:			
Akron	10	10	100
Ft. Collins	58	54	69
District of Columbia	27	23	85
Florida:			
Gainesville	73	73	100
Miami	10	10	100
Orlando	32	24	75
Winter Haven	20	9	45
Georgia:			
Athens	135	112	83
Byron	20	13	65
Dawson	15	15	100
Savannah	28	15	54
Tifton	40	30	75
Watkinsville	18	11	61
Hawaii: Honolulu	22	16	73
Idaho:			
Boise	14	13	93
Dubois	10	9	90
Kimberly	20	19	95
Illinois: Peoria	180	141	78
Indiana: W. Lafayette	14	14	100
Iowa:			
Ames	130	100	77
Ames/Ankeny	26	24	92
Kansas: Manhattan	47	21	45
Louisiana:			
Baton Rouge	10	8	80
New Orleans	139	113	81
Maine: Orono	10	5	50
Maryland:			
Beltsville	615	606	99
Frederick	26	15	62
Hyattsville	10	7	70
Massachusetts: Boston	50	34	68
Michigan: East Lansing	28	28	100
Minnesota: Morris	25	20	80
Mississippi:			
Mississippi State	51	45	88
Oxford	32	32	100
Stoneville	61	53	87
Montana:			
Bozeman	11	8	74
Sidney	11	7	64
Miles City	10	10	100
Nebraska: Clay Center	75	60	80
New Mexico: Las Cruces	15	11	73
New York:			
Ithaca	20	17	85
Plum Island	40	39	98
North Carolina:			
Oxford	16	13	81
Raleigh	31	31	100
North Dakota:			
Fargo	80	69	86
Grand Forks	36	36	100
Mandan	24	20	83
Oklahoma:			

STATUS OF STAFFING OF AGRICULTURAL RESEARCH SERVICE FACILITIES AS OF OCT. 31, 1992—Continued

[Expressed in terms of scientific personnel]

Location	Total capacity scientist	Total in use scientist	Percent staffed
Durant	21	21	100
El Reno	17	9	53
Lane	15	14	93
Stillwater	18	18	100
Woodward	10	6	60
Oregon:			
Corvallis	27	27	100
Pendleton	16	14	88
Pennsylvania:			
University Park	25	18	72
Wyndmoor	150	133	89
Perto Rico: Mayaquez	13	10	77
South Carolina:			
Charleston	14	14	100
Florence	14	13	93
South Dakota: Brookings	12	10	83
Texas:			
Bushland	29	20	69
College Station	56	49	88
Houston	58	44	66
Kerrville	21	16	76
Lubbock	20	20	100
Temple	33	31	94
Weslaco	48	47	98
Utah: Logan	22	21	95
Washington:			
Pullman	11	5	45
Wenatchee	15	9	60
Yakima	15	15	100
West Virginia:			
Beckley	18	18	100
Kearneysville	24	23	96
Wisconsin: Madison	19	17	89
Subtotal, (84 locations with capacity of 10 or more scientists)	3,547	3,032	85
All other locations (23, with capacity of less than 10 scientists)	138	97	70
Total, Federal facilities	3,685	3,129	85

Note—Number of Non-ARS Scientists included above—386.

NEW RESEARCH FACILITIES

Mr. DURBIN. Please describe any laboratory space you have acquired during the past 12 months and indicate the reason why the facilities were acquired.

[The information follows:]

The facilities acquired during the past 12 months are as follows:

Fort Collins, Colorado—National Seed Storage Laboratory with 62,000 square feet. This construction provided additional space that was needed to provide expanded and improved storage for the National Plant Germplasm System. The mission of the National Seed Storage Laboratory is to ensure the long-term preservation of valuable plant germplasm as viable seeds and to conduct research related to maintenance of viability and genetic integrity during storage and regeneration.

Lane, Oklahoma—South Central Agricultural Research Laboratory with an addition of 6,200 square feet, a greenhouse containing 7,700 square feet, a post harvest building with 8,600 square feet, and shop/storage facilities having 7,200 square feet. This completes the construction of this laboratory that was initiated in the 1980's.

The mission of the laboratory is to develop integrated cultural practices for production of fruits, vegetables, and kenaf in the South Central region of Oklahoma and surrounding States.

RESEARCH FACILITIES RELEASED

Mr. DURBIN. Has any laboratory space been released by ARS in the past 12 months, and if so, please describe the reasons.

Dr. PLOWMAN. No laboratory space has been released by ARS in the past 12 months.

ARS-OWNED AIRCRAFT

Mr. DURBIN. Please provide for the record a listing of aircraft owned by the Agricultural Research Service, including where the aircraft are located, the types of aircraft, and how the aircraft were acquired. Also indicate for the record the number of flying hours for each of these aircraft during fiscal years 1991 and 1992.

Dr. PLOWMAN. The Agricultural Research Service owns and operates 7 aircraft located at College Station and Weslaco, Texas. The information on these aircraft will be provided for the record.

[The information follows:]

Location/aircraft type	Method of acquisition	Flying hours	
		Fiscal year 1991	Fiscal year 1992
College Station, Texas:			
Cessna T188C	Purchase	49	127
Cessna P206B	Excess	18	1
Cessna U206B	Excess	62	11
Helicopter, Hiller, 12-E acquired in fiscal year 1992	Excess	—	6
Weslaco, Texas:			
Cessna TU206G	Excess	77	74
Cessna 182J	Excess	17	22
Aero Commander 680	Excess	110	84
Total for all aircraft		333	325

Mr. DURBIN. What were the fiscal year 1992 maintenance costs for each of the ARS-owned aircraft?

Dr. PLOWMAN. The fiscal year 1992 maintenance costs for the ARS-owned aircraft will be provided for the record.

[The information follows:]

Location/aircraft	Maintenance costs
College Station, Texas:	
Cessna T188C	$5,455
Cessna P206B	620
Cessna U206B	454
Helicopter, Hiller, 12-E	1,095
Weslaco, Texas:	
Cessna TU206G	4,000
Cessna 182J	3,190
Aero Commander 680	5,060
Total for all aircraft	19,874

MONTPELLIER, FRANCE

Mr. DURBIN. Would you please describe for the Committee the status of the relocation to Montpellier, France?

Mr. PLOWMAN, ARS research operations have been relocated to leased space in the Science Park at Montpellier, France. Due to a depressed real estate market, the ARS property for sale in Behoust, France, appraised value of $1.2 million, still remains unsold. To date $331,300 has been spent for the purchase of a new laboratory construction site in Montpellier and $100,000 has been committed for professional consulting services. The French Regional and District Governments will be providing subventions totaling approximately $270,000 to assist in the implementation of the laboratory. The Agency is anticipating a contract award for the design of the new 1,590 square meter laboratory in the fourth quarter of fiscal year 1993.

FRESNO, CALIFORNIA RELOCATION

Mr. DURBIN. Would you also describe for the Committee the status of the Fresno relocation?

Dr. PLOWMAN. We have purchased a 104-acre site at Parlier, California. Three acres of land have been cleared for construction of two state-of-the-art weighing lysimeters which should be completed within the next 8–10 months. We have installed an office trailer at the site and have made plans to construct a greenhouse. In addition, we have planted trees of almond, apricot, peach, plum, nectarine, plumcot, and walnut. Funds are not available at this time for the design and construction of the new laboratory facility.

ORLANDO, FLORIDA, RELOCATION

Mr. DURBIN. Would you please describe for the Committee the status of the Orlando relocation?

Dr. PLOWMAN. Our administrative personnel have met with officials of the University of Florida on long-term lease of land for research plots at Fort Pierce and the need to deed to ARS two parcels of land for the main office/laboratory complex and a farm center. Once we complete these arrangements, we will contract for soil mapping and a detail land survey. Following that, we can begin site preparation and planning which will include land clearing, leveling and grading for irrigation, and placement of roads and research plots.

FACILITIES IN OTHER COUNTRIES

Mr. DURBIN. What work is carried out at the facility in Buenos Aires, Argentina and what is the annual budget?

Dr. PLOWMAN. This laboratory conducts research on biological control agents which can be used against immigrant pests originating in South America. We have had past successes in introducing biological agents to control alligator weed and waterhyacinth. Current target pests include imported fire ant, corn root worm, pickleworm, snakeweed, morningglory and rangeland weeds. The annual budget for the Argentina laboratory is $279,400.

Mr. DURBIN. What work is carried out in Seoul, Korea, and what is the annual budget?

Dr. PLOWMAN. This laboratory conducts research on biological control agents which can be used against immigrant pests originating in Asia. We have had past successes in introducing biological agents to control the apple ermine moth in the State of Washington and scale insects on ornamental shrubs. The current major insect target pest is the Asian gypsy moth, a new pest that threatens timber trees in the Pacific Northwest. Aquatic weeds, Eurasian watermilfoil, hydrilla and water chestnut are being researched in support of the U.S. Army Corp of Engineers. The annual budget for this laboratory is $180,818.

REPAIR AND MAINTENANCE

Mr. DURBIN. What is your planned budget for repair and maintenance of facilities in fiscal year 1993?

Dr. PLOWMAN. The fiscal year 1993 budget for repair and maintenance of facilities is $14,246,700.

Mr. DURBIN. How were these funds used in fiscal year 1992?

Dr. PLOWMAN. The type of Repair and Maintenance accomplished consisted of roof repairs/replacement; pavement repairs; HVAC repair; plumbing; electrical; fencing; interior and exterior painting; and replacement of casement, etc.

CONTINGENCY FUND

Mr. DURBIN. What use have you made to date of the Contingency Fund in fiscal year 1993?

Dr. PLOWMAN. To date, we have not expended any Contingency funds.

Mr. DURBIN. How did you use these funds in fiscal year 1992?

Dr. PLOWMAN. The information will be provided for the record.

[The information follows:]

	Amount
Mandan, ND—Irrigation system restoration	$50,000
College Station, TX—Repair/replace irrigation pumps and pipes, lawn mower, lab flooring, insulation, pickup truck caused by flood damage	12,900
Kerrville, TX—Repair/replace telephone system.	36,000
Madison, WI—Replace centrifuge, spectrophotometer, calculators, chairs, etc., damaged by fire	29,000
Brownwood, TX—Repair roads, fences, irrigation lines, pruning tower and building caused by flood damage	69,400
Tifton GA—Replace feed processors, autoclave, balances, incubators, freezers, glassware, dishes, etc., destroyed by fire	41,000
Gainesville, FL—Asbestos cleanup	43,160
Ithaca, NY—Provide for increased funds for taxol research—dedicated computer system, equipment; and fund cooperative project on taxol with Cornell University	100,000
Beltsville, MD—Replace analyzer, spectrophotometer, pumps, water purification system, detectors, etc., destroyed by fire	55,000
Orlando, FL—Repair panes in greenhouse damaged during hail storm	11,305

	Amount
Miami, FL—Purchase supplies (roofing paper, plywood, chain saws, wheelbarrows, drinking water, heavy duty plastic) and repair/replace equipment (front-end loaders, vehicles, computers, phone system) damaged by Hurricane Andrew	45,758
Provide for increased sweet potato whitefly research:	
College Station, TX	20,000
Weslaco, TX	75,000
Phoenix, AZ	70,000
Stoneville, MS	15,000
Tifton, GA	45,000
Beltsville, MD	65,000
Orlando, FL	145,000
Subtotal	435,000
Total, contingency research fund	928,523

Mr. DURBIN. Thank you. Mr. Skeen?

Mr. SKEEN. Dr. Plowman, it is always enlightening and absorbing when you are here and make your presentation. Let me return to the question of Plum Island. How long has that been in existence?

Dr. PLOWMAN. I think we started in 1951.

RISK ASSESSMENT

Mr. SKEEN. So it has been an ongoing operation for some time. I think many times in government we fall error to some of these installations. It is very difficult to terminate an operation and move it somewhere else when you haven't got the budget authority to do so, so you keep trying to maintain the ones you have.

Let me move on to a different topic dealing with risk assessment, particularly as it relates to pesticides. I know that Commissioner Browner has made the statement on behalf of the EPA that the trace level of pesticide residues in foods pose no health risk, yet she listed 35 agricultural chemicals whose use could be prohibited, under the courts interpretation of the Delaney clause.

Are you doing any research in that area of risk assessment? And if so, give me an idea what the results have been.

Dr. PLOWMAN. Yes, we do some work on risk assessment and certainly no one, least of all the Department of Agriculture, would want to recommend anything that would pose a risk to EPA. After all, we are not only helping the farmers who are applying chemicals but as consumers, we are eating it, so we are as concerned as anyone else.

It is ironic in many respects. Some of the foods we eat everyday that have nothing in them have traces of these things that would cause a problem under the same conditions.

Mr. SKEEN. Under natural conditions.

Dr. PLOWMAN. That's right. They are naturally occurring. In fact, I don't think we could get a potato to pass. We would have to quit eating potatoes and tomatoes and things like that. So we have to get to some kind of reasonable approach to these things. The problem that we have got when the Delaney clause was passed, our techniques for evaluating these compounds was such that, if you found them, you probably hadn't ought to have them.

Now, we have developed the techniques that are so sophisticated that we can find what amounts to one drop in the ocean. And, you know, that absolutely poses no risk to anybody, but yet the way the law is structured, we have to throw it out.

Mr. SKEEN. Any trace?

Dr. PLOWMAN. Any trace. Zero. Maybe the thing we did wrong was to develop technologies to find it. Don't take that seriously, but that's the serious problem.

Mr. SKEEN. We will allow you a little artistic license.

Dr. PLOWMAN. There is a risk in getting up in the morning. There is a risk in driving to work. And all of us take that risk. A lot of things we eat and do, we take and assume that it is fine, and it is. So we have got to have some kind of reasonable approach to the Delaney clause. It is going to severely handicap all of us in and outside of agriculture.

Mr. SKEEN. The reason I ask is that fear mongering in this country has become an art, particularly with the media. They have a white sheet of paper, television screens, and airwaves which they have to fill every day. But this fear mongering is devastating for agricultural producers. Yet, you have so little in the arsenal of weapons that you can use to keep people in agriculture.

As you mentioned, when I first came to Congress, 4 percent of the people in the United States were involved in agricultural enterprises. Today, it is down to 2 percent. And that is within the space of about 14 or 15 years. Yet my question was: What kind of a job are we doing to assess the risk in which people of this country can rely on?

And I know that your agency has made a great contribution, but no one wants to believe anybody except those that are agents of the fear mongering. And by the way, that is a great cottage industry in itself. If you can scare the hell out of people, they will donate to you for any reason in the world. And we have a lot of organizations running around Capitol Hill doing exactly that.

Dr. PLOWMAN. I am a firm believer that we have to address the law or we are going to be in terrible trouble in agriculture.

Mr. SKEEN. But you are doing agriculture research on pesticide traces and trying to quantify it and come up with a risk analysis.

Dr. PLOWMAN. ARS measures and quantifies pesticide residues in many of our research projects and this data is often used by regulatory agencies to analyze risk and establish risk tolerance levels.

Mr. SKEEN. We appreciate your work in this regard. The products get better every year.

Mr. THORNTON. Mr. Chairman, I appreciate your yielding to me earlier. I want to follow Mr. Skeen's line of questioning with one particular example.

A few years ago, it is my understanding that a French fungicide for use on hops—a pesticide fungicidal agent which had a calculated theoretical risk of raising one tumor, not surely carcinogenic, but at least a tumor, among a population of 100 million over a 70-year exposure, a risk of 10 to the minus tenth—was prohibited for use on hops, even though it would have replaced a pesticide permitted by the grandfather clause, which had a risk of 10 to the minus fifth or one in 100,000. A huge additional risk was required because

of the patchwork quilt system of regulation which does not provide for a uniform standard of negligible risk.

Are you familiar with that particular example? Are there not examples where the safer product is prohibited by the action of this zero-risk standard where the health benefit would be greatly improved by allowing the lowest risk product to be used?

Dr. PLOWMAN. That is true, Mr. Thornton, and there are a whole lot of other examples just like that. Another thing, if I might, another big problem we have got is a commercial company now has to reregister all pesticides if they are going to continue to use them. Now, it is a very expensive process to prove affect and efficacy and so on, and so we have a lot of agricultural chemical companies that are not going to register things that we need in agriculture because it is too expensive and the use of it would not be great enough for them to recapture their investment.

So what is happening, we are losing pesticides that we need for what we call minor uses. And those things are mostly on our fruits and vegetables. So we are going to have to get used to eating fruits and vegetables that have pock marks and insects if we are not careful. The minor use pesticides that we are using is a real issue for us.

Mr. THORNTON. Thank you. I yield back.

Mr. DURBIN. Ms. DeLauro?

Ms. DELAURO. Thank you. It is good to see you again. And I will try the lupine pasta.

Mr. DURBIN. You are a real expert.

Ms. DELAURO. Normally to have it nonsticking, I just add a little olive oil.

TAXOL RESEARCH

I am interested in the ARS's support of taxol research and I have a specific interest in that effort. You may not know, but I am a survivor of ovarian cancer and was very active last year in working with the Pacific Yew Act in an effort to get taxol to the market, utilize the Pacific yew tree while trying to be environmentally conscious as well, but to develop large quantities of taxol.

FDA has approved taxol in the treatment of refractory ovarian cancer and now there is a great deal of pressure to look at commercially viable alternatives in the production of taxol.

I understand that ARS has been supporting that kind of research effort and extracting taxol from the ornamental yew bush. That was indicated in the testimony. Is that correct? And if it is correct, what progress has been made to complete that kind of research?

Dr. PLOWMAN. Well, taxol looks like a great thing, but our opinion is that there is not—if it is as good as it looks, there is not going to be enough trees in the world to strip for taxol. That's the whole problem. That says we have got to figure out a different way to make that or find it in a different place.

So we are looking at some alternatives now. One of the things that we have patented and licensed to process now is to make taxol by a tissue culture process. And that is working pretty well. Let me ask Dr. Tallent to tell us the state of that art? Bill.

Dr. TALLENT. The state of it is we have a CRADA with Cornell University and Phyton Catalytic Inc., which is a small company that was the spin-off from the university. And they are working at the pilot plant level to develop and scale-up the process and increase the yield of the taxol through the tissue culture approach.

Ms. DELAURO. As you probably know, Bristol–Myers Squibb had a CRADA with the National Cancer Institute. Tell me about the coordination of this and whether Bristol-Myers Squibb is contributing to your efforts.

Dr. TALLENT. That is correct, and the National Cancer Institute is helping to fund the research. The whole taxol effort is very well coordinated.

Ms. DELAURO. About what percentage of your budget is being spent on the taxol research?

Dr. PLOWMAN. We are not spending a whole lot of money about $50,000.

Mr. MYERS. Is that enough to really move it?

Dr. PLOWMAN. Well, probably enough right now, until we get a little better direction. There are several approaches. It would be nice——

Ms. DELAURO. I didn't mean to interrupt you, but to follow my colleague, from where are you getting the direction on moving on the issue of taxol and the research?

Dr. PLOWMAN. I am not sure what you mean, where are we getting our direction?

Ms. DELAURO. Is it NIH? Who is providing the impetus and the direction that you ought to be going in? Is it National Cancer Institute that you are working with in terms of your own research into the effort?

Dr. PLOWMAN. Yes, as Dr. Tallent says, the taxol effort is a well-coordinated activity between the Department of Agriculture and the National Cancer Institute. We each know what the other is doing. The efforts going on are on several fronts. It would help if we could synthesize taxol and make it in a test tube. We haven't been able to quite do that yet.

That is part of the effort, to see if you can synthesize the active ingredient. The tissue culture method, to produce the product that is now being used is another approach that we are trying. And we are also looking, in the State and Federal effort, to see if we can find it in some other kinds of the taxol genus of trees. Because you know we grow lots of these besides the Pacific yew. And also which parts of the tree produces the greatest yield? So it is a coordinated effort going on and I think quite successful.

Ms. DELAURO. Let me ask you this question: Thirty-nine percent of women in this country survive ovarian cancer. We know, as you pointed out, that we don't have enough Pacific yews in order to produce the taxol. $50,000 is being utilized to look at commercially viable alternatives.

To pick up on what my colleague was saying, what in your view should ARS be doing in terms of looking at ways in which we can move quickly to produce the quantities of taxol that we need in order to save the lives of American women? Taxol is now being viewed as being helpful in the treatment of breast cancer as well. I

want to get your sense and what your thoughts are on the direction that we ought to be taking in this area.

Dr. PLOWMAN. Well, we need to move ahead in all fronts that I've talked about. For example, if we thought right now, if in our communication with Bristol- Meyers and the National Cancer Institute it looked like the active ingredient could be synthesized, then that takes care of the whole problem and there would be no use in cranking up the whole Department of Agriculture to produce it other ways.

Lacking that, we need to be aggressive in finding out and locating other sources besides the Pacific yew. And we are doing that. Tomorrow we will see material from Dr. Jordan of the Cooperative State Research Service, and they have had a program with their granting program, also with a company in Ohio, a nursery company, to look at some of the other genus of plants that might produce taxol, and they have collected it in leaves and needles and so on.

So you never have enough, and there are never enough resources. Yes, we could spend more money, certainly, and possibly speed up the process, but the key really goes back to how close the synthesis is, and I just don't know the answer to that.

Mr. DURBIN. Would the gentlelady yield?

Ms. DELAURO. Yes.

COORDINATION OF TAXOL RESEARCH

Mr. DURBIN. Dr. Plowman, I'd like to follow up on what I think Ms. DeLauro is aiming at and the question that I would like answered is: Is someone coordinating this effort? There are a lot of private companies and Federal entities that are interested in this issue that is clearly vital to a lot of people.

Is someone looking into this to see if $50,000 is sufficient or if three times that amount were invested it might help more. Who is coordinating the overall effort?

Dr. PLOWMAN. The National Cancer Institute is coordinating the total effort and our workers have interaction with them.

Ms. DELAURO. Okay.

Dr. PLOWMAN. They are spending millions of dollars in conjunction with Bristol-Meyers.

Ms. DELAURO. I understand that and I wanted to know what percentage of the funding Bristol-Meyers is putting into this effort versus the federal dollars that are going into this. And I wasn't assuming that you would have the answer to that question, but I am very, very interested in getting any information on what ARS is doing with taxol, the amounts of money, how is this coordinated, who is in charge.

To use your terms, where is the direction coming from that tells you what they think that you ought to be doing and what Cornell University ought to be doing, and if we do have a CRADA there. We do have a CRADA with Bristol-Meyers Squibb. There is a passion that I have because of my own concerns about this effort.

And we need to move as quickly as we can to save the lives of women in this country who are being diagnosed accidentally and surviving accidentally. And that is really unacceptable to, I think, all of us.

Dr. PLOWMAN. We certainly agree with that. If the synthesis thing looks like it is a little ways off, then the production of the natural product could be greatly enhanced by a significant effort in ARS, there is no question of that.

Ms. DELAURO. Thank you very much.

Mr. DURBIN. Mr. Myers?

Mr. MYERS. Dr. Plowman, following up on Ms. DeLauro's question, is the $50,000 coming out of your request or is it coming from NCI?

Dr. PLOWMAN. No, it is our program.

Mr. MYERS. So if we in this committee decide to put more money into it, you would get the money to do the research.

Dr. PLOWMAN. That is correct.

MODERNIZATION OF ARS LABORATORIES

Mr. MYERS. Because of the urgency of this, it seems that we ought to go down both roads and one will be sure to take us there. But it may be five years and it may not work. That is something that we would have to decide when we start marking up, if ever.

The modernization of the ARS buildings and facilities, how much did you request for this from the Secretary?

Dr. PLOWMAN. I'm sorry; my good colleague was trying to give me some information and I apologize.

Mr. MYERS. Modernization of buildings and facilities, how much did you request be put in your budget?

Mr. GARBARINO. For which year?

Mr. MYERS. We are talking about 1994.

Mr. GARBARINO. At the Agency stage for 1994? I can provide that for you, Mr. Congressman. I don't have the 1994 budget finalized.

Mr. MYERS. What is needed in the modernization out there?

Mr. GARBARINO. One of the items is a pilot plant for the Peoria laboratory.

Mr. MYERS. A pilot plant for Peoria?

Mr. GARBARINO. Yes, sir.

Dr. PLOWMAN. In the 1994 Agency estimate, we were talking about an increase for construction and modernization of $153 million.

Mr. MYERS. For all of the facilities?

Dr. PLOWMAN. That's right. The problem is that we have got a lot of these facilities that were built 40, 50 years ago, and we have just not kept up with the safety and health standards and state-of-art modern facilities that we really need.

PEORIA MODERNIZATION

Mr. MYERS. What would be typical modernization work at Peoria as an example? What will you be doing at Peoria?

Dr. PLOWMAN. One of the things that Peoria needs badly is a pilot plant. When that was constructed, we put in a pilot plant, but it is no longer adequate for the kind of work that is done there. We need to develop a pilot plant that is done in modules where we can cooperate with industry to bring things in and out and have our scientists working with industry. So we have estimated a pilot plant renovation for 13.2 million dollars.

Mr. MYERS. How soon could you start that?

Mr. GARBARINO. That could be done immediately.

Dr. PLOWMAN. We have the engineering done. That could be part of the stimulus package.

Mr. DURBIN. The stimulus package includes 34.5 million for your facilities.

Dr. PLOWMAN. And that is part of it.

Mr. MYERS. How are you going to spend that 37.5 million?

Mr. GARBARINO. We have several projects at Beltsville here. There is a modernization project. They are gutting and modernizing a laboratory building there for $10 million. We have a water line system that we need to replace at the National Arboretum costing $2 million and further modernization work up at Plum Island for approximately $3 million.

We need an incinerator and necropsy facility out at our Ames, Iowa facility for a total of $3.9 million. And we have a number of locations for $2.4 million for just repair and maintenance types of activities like window replacement and roof repair and so forth.

Dr. PLOWMAN. But I should say all the engineering has been done on all of these things. That money could be spent and put into the economy tomorrow.

Mr. MYERS. Okay.

Mr. GARBARINO. All of these items, as well as some hazardous waste underground tank removals, are all ready to go on that docket for 37.5 million.

RESEARCH IN SUPPORT OF ACTION AGENCIES

Mr. MYERS. You discussed in your statement here the regulatory requirements from EPA and DOD and other agencies. When you are required to do this research for other agencies, do they pay you for it?

Dr. PLOWMAN. Most of the time they are a cooperative effort where they don't have either the facilities or the scientists to do that. But it is important to them, and if it is also important to us in agricultural research, then we join them as a cooperative effort.

Mr. MYERS. Do they pay part of that or do you do the work and they take the results of it? Who pays for it? That is what I am trying to find out.

Dr. PLOWMAN. We pay for some of it and they pay for some of it. We work with the Corps of Engineers, for example, on keeping the waterways clean down in Florida. They pay us.

Mr. MYERS. You do all of that research.

Dr. PLOWMAN. That's right. We do work for them because we have the scientists and people that can do it and they give us money. The Army gives us some money on the control of insects. We have gotten money from the Army, for example, for some of the food items for the military.

But it depends on the specific issue.

MELALEUCA

Mr. MYERS. How are you coming on that tree that sops up all the water in Florida?

Dr. PLOWMAN. The Melaleuca. That is a difficult problem.

Mr. MYERS. Have you made any progress on doing something about that?

Dr. PLOWMAN. We have a biocontrol laboratory in Australia. That is where that tree is native. They sent us five or six candidate insects and some pathogens that might be effective in that. It is not a problem in Australia. It is under control, through these natural predators and things.

ANIMAL WELFARE

Mr. MYERS. What is the status of ARS's involvement in animal welfare research? Would you say that the amount of resources ARS is putting into this area is adequate? Is the work ARS is doing in this area being undertaken in conjunction with universities?

Dr. PLOWMAN. A new ARS program on animal well-being research has been initiated at West Lafayette, Indiana. ARS is now recruiting for two research scientist positions on animal behavior and indicators of animal well-being. A specific cooperative agreement is being developed with Purdue University to initiate an animal well-being program involving a visiting scientist and post-doctoral researchers while recruitment is in progress. The social issues surrounding animal well-being and general welfare of animals are complex and need to be approached from a multidisciplined scientific basis. The current funding level of $500,000 at West Lafayette will provide adequate support for the scientists to begin developing science-based information in animal well-being. Given the wide range of animal research issues and total ARS funding levels, this is an appropriate level of support for this new effort. We will review progress as the program develops and consider funding adjustments. ARS is cooperating with agencies in USDA and the university system in sponsoring a workshop on animal well-being. The workshop will address researchable problems and priorities, public issues and policy, regulations and guidelines, and production agriculture, In addition, $1.2 million in animal well-being and stress physiology research is being done at Clay Center, Nebraska, and Beltsville, Maryland. ARS was able to financially assist scientists at Pennsylvania State University through a specific cooperative agreement to complete several projects on animal well-being of veal calves.

ARS GOALS

Mr. MYERS. The goals of ARS are to maintain a quality environment and at the same time make sure our farmers and ranchers remain competitive domestically and internationally. Can't these two goals be considered competing efforts? Please explain.

Dr. PLOWMAN. Public concern has increased about the effects of air and water pollution on the environment, depletion of non-renewable resources, waste management, and potential effects of global change. At issue is the role of the agricultural sector as a contributor to or a solver of environmental problems contrasted with the need to sustain supplies of agricultural products for domestic consumption or export.

In the short term, farmers and ranchers may realize greater competitive advantage by using management practices that detract

from a quality environment. However, it is seldom, if ever, advantageous to abuse the resource base that supports the agricultural system in the long term.

ARS is committed to find ways to increase the competitiveness of farmers and ranchers while at the same time maintaining a quality environment. Some of the research initiatives that promote a quality environment and increase competitiveness include Integrated Farm Management System research, no-till and other conservation tillage and other residue management systems, improving chemical application technologies, enhancement of plant and animal germplasm to overcome productivity barriers, and environmentally compatible pest control.

I will provide specific research examples for the record.

[The information follows:]

No-till crop production was developed primarily to control erosion. However, research has shown that runoff of agricultural chemicals is practically eliminated and crystal clear water exits into streams or from tile lines rather than muddy contaminated water. U.S. no-till cropland has increased from about 5 percent in 1980 to over 10 percent in 1990 and is projected to increase at least 3-fold by the year 2000. Profitability has also improved where no-till is being practiced primarily in the Midwest.

Scientists in Illinois have shown that weeds can serve as a "cover crop" early in the season and that less than 1 ounce/acre of postemergence herbicide can control weeds in established corn and soybean fields. Postemergence herbicides are less mobile and degrade faster.

Researchers in Mississippi have developed and demonstrated that ultra-low-volume herbicides and sensor sprayers can reduce herbicide application by 90 percent, thus reducing the potential for environmental degradation.

Research in North Carolina shows that water table management in coastal plain areas can increase yields by 20 percent, reduce runoff by 50 percent, and cut nitrogen and phosphorus losses by 30 percent and pesticide losses by 50 percent. Such reductions are significant to the continued productivity of the nation's estuaries and coastal zones.

A computerized cotton management system, GOSSYM/COMAX, is being used by over 300 farmers who claim a net benefit of about $50/acre on 500,000 acres.

Newer irrigation systems and improved water management in Arizona, Colorado, Idaho, and California have shown increased production and profitability by applying lower amounts of agricultural chemicals along with the water and resulted in reduced contamination of ground water. Drip irrigation is being practiced on 1.3 million acres in California.

PLANT GENETIC RESEARCH

Mr. MYERS. ARS has both a plant science and animal welfare research effort ongoing at Purdue University. Please comment on the nature of the effort at Purdue to develop genetic resistance to diseases and insects of crops. What amount of your $660 million in Fiscal year 1993 funding will be obligated for plant genetic research?

Dr. PLOWMAN. Current ARS plant genetic research conducted at West Lafayette, Indiana, focuses upon improving soybean quality and disease resistance, the biochemistry and genetics of disease resistance in corn and sorghum, manipulation of storage protein structure in soybeans, and small grain insect resistance. Additionally, new programs are being erected to determine the molecular basis of resistance, in wheat and other cereals, to barley yellow dwarf virus, fungal leaf diseases other than rusts, and Hessian fly. The amount of the total ARS budget devoted to plant genetics and breeding is nearly $62 million. This includes research on molecular and cellular genetics, growth and development, plant genome map-

ping, germplasm evaluation and germplasm enhancement and breeding.

ANIMAL WELFARE

Mr. MYERS. Please describe the impact of the animal welfare research program at Purdue on your ability to meet national goals in this area. With what other universities does ARS have a presence for animal welfare research efforts? What amount of your $660 million in funding for fiscal year 1993 will be used for this type research?

Dr. PLOWMAN. The research at West Lafayette, Indiana, will be an important part of the ARS national research program on animal well-being. It will complement Purdue University scientists to research the complex issues on animal well-being using multidisciplinary approaches. The cooperative team is expected to contribute to national goals in the general area of well-being of beef and dairy cattle. ARS does not have a presence with other universities on animal well-being research. In fiscal year 1993, $1.7 million is being used for animal well-being research. Of this amount, $500,000 is allocated to West Lafayette, and the remaining $1.2 million is distributed between Clay Center, Nebraska, and Beltsville, Maryland, for animal well-being and stress physiology research.

PIONEERING TRANSFER OF NEW TECHNOLOGIES TO THE PRIVATE SECTOR

Mr. MYERS. ARS has worked with commercial firms in the past few years on establishing CRADA's to move research from the laboratory into the marketplace. Please describe the work ARS has done in pioneering the transfer of new technologies to the private sector. Have other Federal agencies followed that procedure in working with the private sector?

Dr. PLOWMAN. ARS has aggressively implemented the Federal Technology Transfer Act of 1986. The first Cooperative Research and Development Agreement implemented by a Federal agency under the authorities of this law was in 1987 between ARS and Embrex, Inc., of Morrisville, North Carolina, to develop and commercialize ARS invented technology for *in ovo* vaccination of chicks. Since then 295 CRADA's have been signed by private firms and ARS as of the end of February 1993. These agreements are usually for a duration of 3 to 5 years, so each year some are completed and some new ones are negotiated. The early CRADA's are beginning to pay off in economic benefits. Eight products developed under them have been commercialized. Of the 185 ARS-Industry CRADA's currently in effect, 28 are with small rural businesses, a special emphasis of the ARS technology transfer program.

Another ARS first under the FTTA was the establishment of the Biotechnology Research and Development Corporation of Peoria, Illinois. This is a consortium involving ARS, the University of Illinois Biotechnology Center, and five large industrial firms with major interests in agricultural biotechnology.

The procedures used in the ARS technology transfer program with industry are those authorized by the FTTA and mandated by Executive Order 12591. Other Federal agencies use similar procedures, and the Government-wide effort is coordinated by an inter-

agency committee chaired by the Department of Commerce. ARS's leadership in Federal technology transfer is widely recognized and is well documented in the Department of Commerce's legislatively mandated biennial report on implementation of the FTTA. In addition, NASA's Technology 2002 Award for outstanding achievements in technology transfer was presented to ARS in December 1992.

Mr. DURBIN. Thank you, Mr Myers.

Mr. Peterson?

Mr. PETERSON. Thank you, Mr. Chairman, look at all the products. Are you sure you didn't develop the microwave oven, also? There are a lot of these things that hook together here.

Dr. PLOWMAN. We didn't, but I wish we had.

ORLANDO, FLORIDA LABORATORY

Mr. PETERSON. I would like to follow on my colleague here on your facilities. I am aware of a facility in Orlando that you have had on your map for a long time for upgrade to another location. Can you, for the record, give us a little history on that, and then how much of an appropriation we are going to have to have in order to make this happen, and then, of course, what the benefits are?

Dr. PLOWMAN. Okay. We have a citrus research laboratory in Orlando, Florida. When we built that laboratory 40 years ago, it was out of town. And you know what's happened to Orlando Florida. Now it is in the middle of town and there are people all around it. And so that is one thing. The laboratory is old. Further, it is not in the citrus belt anymore. The citrus belt has moved south of there.

In addition to that, we have had the mayor of Orlando request us to leave. They want to use that facility and site for other purposes. So we have had a lot of pressure to do that and it is not serving our needs anymore. With all that in mind, we have proposed to relocate that laboratory further south. During this last six months, a decision was made to relocate it down near Fort Pierce, at a site down there that is in conjunction with the University of Florida. So that is the plan.

It would cost us about $33 million to relocate and build that laboratory. So that would be the proposal if this committee appropriated the money to do that. Again, why should we do it and what are the benefits?

Well, the benefits are that—history is the best predictor of the future. We wouldn't have such a great citrus industry in Florida if it wasn't for the ARS laboratory. And my guess is we won't have one in the future unless we continue to do that kind of work.

Mr. PETERSON. And what's the significance of being essentially within the citrus belt with that laboratory, as opposed to having it in Chicago?

Dr. PLOWMAN. Well, it's harder to raise orange trees in Chicago. We need to work where the citrus people are that are producing, where our scientists are working directly with the industry. They know what the problems are. If we are developing varieties or insect controls, we need to be working right there where the problems are.

Mr. PETERSON. And you say in the way of appropriations, $33 million? What is the first year requirement? I assume you can't use that all in one year.

Dr. PLOWMAN. That's correct. Most building programs go through cycles. And our history says it takes five or six years to gather up enough money to do a project like that. We need planning funds and money to do an architectural design. This amounts to $2.9 million for this project. Then it usually takes several years to get the appropriation money for construction, which in this project amounts to $33 million.

Mr. PETERSON. Have you put something in the budget this year for that project?

Dr. PLOWMAN. We would need money this year for the planning and architectural work. Now that we have a site, we need some site preparation work. We need $2.9 million to initiate the design project.

Mr. PETERSON. Okay. I would like to look at that further if you will.

Dr. PLOWMAN. We could get you details on that.

POTENTIAL IMPACT OF NAFTA

Mr. PETERSON. Particularly in view of what is happening in world trade. Especially with NAFTA and its impact on citrus.

You have created new products that obviously are going to benefit the Florida production. What is the potential of that technology reaching what will soon be our competitors, such as Mexico? Is there a transfer of technology to our foreign producers as well as our own local producers?

Dr. PLOWMAN. Well, it doesn't matter whether you like to or not. Foreign people, you know, they copy us. They want to do what we are doing. These grapes here weren't grown in California, they were grown in Chile.

Now, I don't mind that because it is not our grape season. So if we want to eat these things in the winter, I am glad Chile is growing our grapes and shipping them here where we can buy them. They don't compete with us because their seasons are different and that is fine. But I would expect that a lot of the technology that we develop will be copied by farmers in Mexico.

And, again, that is why we have to keep on the fast track to keep our producers ahead. And I think that is especially true about some of the things happening in Florida. The situation in Mexico is that a large part of the growing areas are very scarce on water and I don't believe they will be able to compete with us in the production of crops. But they will have our technology.

TECHNOLOGY TRANSFER

Mr. PETERSON. Tell me a little bit about the transfer of that. Do we just put it out on the market and it is there? Or is there some licensing or do they come and buy some of our markets and go down and reproduce their own? How is that done?

Dr. PLOWMAN. Well, the United States is very good about that sort of thing. Anybody can come here and buy a bushel of seed or a tree and take it just about anywhere. And they do that.

I don't know of any restrictions that would be placed on Mexico preventing them from coming to Florida and buying a new grapefruit tree and take it back to grow it. Pretty soon they would be competing with us.

Mr. PETERSON. We are going to have a transition, it seems to me, in agriculture as a result of some of our trade agreements, which would suggest to me that there are going to be areas where we were raising a product that now becomes marginal or almost fiscally prohibitive to produce.

So are you tasked to look at that aspect and then to suggest a new product or a new crop that could be produced in an area that will be essentially devastated by the drop of that other product?

Dr. PLOWMAN. Yes, as a partial answer to that, we are always looking for options and alternative crops for farmers to grow. And there are some new crops. This lupine is one of them. The muscadine grapes is another one. One of the products that I didn't mention previously is this one.

This lipstick included in your packets is responsible for a brand-new crop that we are developing. The oil, one of the basic ingredients in the lipstick, is castor oil and the United States grows no castor beans. But we found a substitute for castor oil. So we are looking for new crops that will keep our farmers in business.

The one thing we can do in this regard is to keep pushing our technology for our own farmers so that they can compete. We will probably never compete with labor costs in some of these other countries, so we have to use all the technologies that we can with better production practices.

RESEARCH ON PETS

Mr. PETERSON. One final question. Obviously in this country, the pet business is a multimillion dollar, if not billion dollar operation. Have you looked into the research of companion pet disease control, better nourishment and those sorts of things?

Are you not obliged to deal with that, given the fact that the industry is so big it uses so much of our agriculture product.

Dr. PLOWMAN. No, we have never done work on companion animals. We have never been authorized or had money appropriated to do that kind of work.

Mr. PETERSON. Do you think that would be beneficial? Is that significant to the use of our ag products, particularly the ag by-products?

Dr. PLOWMAN. Well, it would help. It is a controversial issue. Should the government be funding things like companion animals, horses. We don't do any work on pleasure horses.

Mr. PETERSON. Does industry do the work on that, is that the trade-off?

Dr. PLOWMAN. Industry and manufacturers do that kind of thing.

Mr. PETERSON. Thank you.

Mr. DURBIN. Mr. Pastor?

SWEET POTATO WHITEFLY

Mr. PASTOR. Thank you, Mr. Chairman. Good morning. On page 2, you have, "Recent efforts pertaining to the sweet potato whitefly show our ability to respond quickly to the problem." You responded quickly because it is still a problem in the southwest, as you know. The whitefly started with cotton and went out to the winter vegetables, and now it likes watermelon and cantaloupes.

Dr. PLOWMAN. The first thing I would tell you is that we've responded quickly to that problem. However, we are not going to solve that problem very soon, in spite of the fact that it is a terrible problem and we are working hard on it. It is going to take some time to do it. To respond quickly, we mobilized our scientists from Phoenix, Weslaco, Florida, and the Imperial Valley out to the Imperial Valley of California where that outbreak started.

We formed a consortium with a number of universities and with a number of other federal agencies that are concerned with it, especially APHIS. We developed a five-year plan to attack this problem, and that is going very well. We have moved a few resources around. We don't have as much money to work on that as we'd like, but with the capability that we have, we think we have a pretty good effort.

We have done a couple of things that looked promising. We found a natural predator down in Texas that has a voracious appetite for the whitefly and we have gotten together with commercial organizations that are mass producing that predator and those will be released this year through commercial sources into some of the problem areas.

We have evaluated some ag chemicals that are on the shelf now. We found two ag chemicals that looked like they have some possibility of helping in the near future. There is another chemical that looks good and we are helping to gather the data so that EPA will give us an experimental use permit. So that all looks good.

We have had a massive program to look for predators, parasites, and pathogens that we might introduce here. And we have had our scientists from our laboratory over in France that work on biocontrol going to the countries where this whitefly is native, to find out where and what is keeping it in check in those countries.

We now have seven or eight good candidates that have been sent here from those collections that we are evaluating.

Mr. PASTOR. Could you expand on the lack of resources. You said, if we had more resources, we could probably expedite the five-year plan. Could you give us an estimate?

Dr. PLOWMAN. One of the frustrations that we have is having a problem like sweet potato whitefly and not being able to put the necessary resources we need on it. We need $2 million to really step up a program to adequately impact that.

IRRIGATION

Mr. PASTOR. In the west, as you know, irrigation is the way of farming. Have you done any research on effective irrigation, that is, how to use irrigation more effectively?

Dr. PLOWMAN. Yes, we do. That is a big agenda in our mind. And in fact we have a laboratory in Phoenix. It is called the U.S.

Water Conservation Laboratory and they deal with that. Most of the technology that has been developed on new methods of irrigation, the laser leveling, all came out of that laboratory.

A lot of concepts on drip irrigation came out of that laboratory as well. In fact, we have Dale Bucks here—he is in Beltsville now—on the national program staff. But he spent how many years there?

Dr. BUCKS. I started in 1970 when there was 50 acres in plastic pipe irrigation, so I am sort of a pioneer.

Dr. PLOWMAN. He has almost more experience on that than anybody else. It is a big issue. We are not going to produce crops in the west without irrigation. And there are a lot of problems with it. We need to have a lot of water use efficiency. Water is drying up. You know the problems in California. We need to have some research on the water use efficiency in that part of the country.

When you irrigate, you have problems associated with erosion. When you are running water off the end of the row, you usually are eroding soil. You have problems with suppression of pests when you irrigate, too. So we have laboratories working on that. We have one in Fresno, California, one in Kimberly, Idaho, and the water conservation laboratory in Phoenix, Arizona, where we are very much involved in irrigation.

Mr. PASTOR. Is it adequately funded or is there need for additional resources? This affects the whole west.

Dr. PLOWMAN. I wish you wouldn't ask those questions because my heart tells me that you never have enough. If I asked 500 researchers if they have enough money, they would say no. And it is probably true, but that is just the way it is.

MARICOPA, ARIZONA

Mr. PASTOR. The University of Arizona recently developed a research farm in Maricopa. Are you affiliated with them in any way?

Dr. PLOWMAN. Yes, we are. The work we do in Arizona is a cooperative program with the University of Arizona and we have scientists, in fact most of our scientists that are physically located in Phoenix, do their plot work down at the Maricopa station. In fact, that is another area like Orlando. The city has grown up around our laboratory there. And we need to move it some day and that would be the place to move it.

Mr. PASTOR. What keeps you from moving?

Dr. PLOWMAN. It is called "dollars."

Mr. PASTOR. Oh, okay. $2 million. Why don't you bring the citrus research center to Arizona and we could move you to Maricopa and solve the problem?

Dr. PLOWMAN. You and Mr. Peterson get together and solve that. I don't want to get into that argument.

Mr. PASTOR. The lab is right in the middle of an expanding area and it is probably worth more to develop that land commercially. What dollar amount are you talking about to move the research station?

Dr. PLOWMAN. We did a feasibility study and I don't have those figures in front of me, but I would be glad to submit them for the record. We did a feasibility study on what it would cost for us to move down to Maricopa.

[The information follows:]

Congressional Directive Relating to the Feasibility of Moving the USDA-Agricultural Research Service Laboratories from Phoenix to Maricopa, Arizona

House Report No. 102-119, accompanying the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriation Act, 1992 (Public Law 102-142), contained the following directive by the House Committee on Appropriations:

> "The Committee is aware of proposals to relocate the ARS facility in Phoenix. The Committee will expect a report on these proposals."

Senate Report No. 102-116, also accompanying the law, contained the following directive by the Senate Committee on Appropriations:

> "The Committee concurs with the House in requesting a report on the feasibility of moving the Water Conservation Laboratory and the Western Cotton Research Laboratory from Phoenix, AZ, to the Maricopa Agriculture Center in Arizona."

The U.S. Water Conservation Laboratory (USWCL) conducts research to increase water use efficiency in agricultural production for the irrigated West and to conserve and improve the quantity and quality of our Nation's water supplies. The current facility includes office, laboratory, greenhouse, shop, and storage space of approximately 40,000 square feet. It was constructed in 1959 on about 5 acres of land in the outskirts of Phoenix. The facility currently houses 18 scientists and 25 support people with an annual base funding of $3.4 million.

The Western Cotton Research Laboratory (WCRL) was constructed in 1971 on about 7.5 acres of land neighboring but separated from the U.S. Water Laboratory facility. It provides about 45,000 square feet of space for 16 scientists and 22 support positions with an annual operating budget of $2.5 million. The mission of the WCRL is to increase the efficiency of producing cotton in the irrigated West to ensure that U.S. cotton will be competitive in both price and quality in the world market. This includes research to develop improved cotton varieties, especially the extra-long staple Pima cotton, and to develop environmentally acceptable methods to control cotton insects including the pink bollworm and the sweet potato whitefly.

The Agricultural Research Service (ARS) conducts cooperative research with the University of Arizona. Originally, the ARS laboratories in Phoenix utilized an adjacent University of Arizona research farm to conduct large scale field plot experiments essential to support the water conservation and cotton production research programs. Encroaching urbanization and the concerns of residents in the area, however, resulted in the University terminating the use of this land for farming and research purposes. The University established a new large farming and research facility near Maricopa. Due to the unavailability of field plot land near the Phoenix location, the ARS researchers must now travel about 28 miles to the Maricopa Agricultural Center (MAC) to conduct their field experiments.

In addition to the loss of time and research efficiency associated with this daily travel, it is recognized that if the laboratories are to remain housed at Phoenix, renovation and expansion of current facilities will be needed to meet existing safety and health codes and to provide for some degree of updating of research facilities. Furthermore, concern has been expressed that the encroaching urbanization and the potential for high-rise buildings adjoining the laboratories may eventually limit even the ability to conduct greenhouse and laboratory research at the present site.

As an alternative to housing the laboratories at Phoenix, the University of Arizona (UA) has invited ARS to consider relocating facilities to MAC in order to strengthen the cooperative research between ARS and the University as well as locating ARS scientists closer to the experimental field plots. In response to the invitation, representatives of ARS and UA administrators, scientists, and facility engineers conducted a preliminary study to assess the feasibility of this possible relocation. Industry representatives were also consulted.

Building and field experimental sites other than those at Phoenix and MAC were considered by the study group. From a research program standpoint, the unique land and irrigation facilities already in place at MAC, plus the closer alignment with UA, led to the conclusion that MAC is the best available site among the sites considered in the irrigated West for the experimental field work. The following options were identified by the study group and other ARS officials for the location of needed facilities:

Option 1 -- Continue to house the two laboratories at Phoenix and carry out only the renovation needed to meet current safety and health building codes. Scientists would continue to commute to MAC to conduct their field plot research.

> Cost - In December 1990, Earl Kai Chann and Associates, Ltd., competed a facility condition study for the Phoenix location to upgrade the facilities to meet existing safety and health codes. The FY-91 construction cost was estimated at about $2.1 million.

Option 2 -- Continue to house the two laboratories at Phoenix and, in addition to the renovation needed to meet current building codes, minimal upgrading would be completed to provide for some state-of-the-art instrumentation to enable the laboratories to maintain efficient and productive research programs in the future. Even though there would not be an increase in the number of scientists, this would entail some laboratory modernization and an increase in greenhouse and environmentally controlled research space from 85,000 to a total of about 98,000 square feet for the two laboratories.

Cost - Estimated costs range from $12 to $13 million, including the earlier referenced building code requirements.

Option 3 -- Relocate all current Phoenix programs and staff to new physical facilities at MAC on a site that would be made available to ARS. Although the number of scientists relocated would remain the same as currently at Phoenix, there would be modern and additional laboratory and greenhouse space at MAC to meet updated program needs.

Cost - Planning and design of new facilities has not been initiated. Based on an initial estimate of facility requirements and specialized research equipment, estimated costs range from $35 to $38 million. With modern construction utilizing energy conservation technology, operation costs are estimated to be about the same at MAC as at Phoenix.

Option 4 -- Relocate all current Phoenix programs and staff to existing or planned ARS facilities in Texas and/or California where similar program functions are conducted.

Cost - Costs associated with this option would involve the one-time relocation of staff and the disposition of Federal real property. Also, some cost modifications of the existing or planned facilities in Texas and California may be required to accommodate the relocated staff.

Consideration of Options

Option 1, renovation to meet building code requirements, requires the lowest outlay of funds but requires continual commute of scientists to MAC to conduct field studies.

Option 2 would combine needed program modernization with the building code renovations. The scientists, however, still would be required to commute to MAC. In addition to the cost of lost research time associated with this commute, the cost of research opportunities that are missed because of the inconvenience of traveling to MAC as often as desired or needed must also be considered.

Option 3 is the most costly but would provide the following benefits:

- Promote close alignment with the University of Arizona to foster improved interaction with University researchers and Extension specialists, and increase the potential for working with graduate students.

- Provide full access to the land and irrigation research and demonstration facilities already in place at MAC with the potential of developing a major center for irrigated agricultural research. This center would also facilitate technology transfer to growers and industry.

- Increase work time and efficiency by up to 25 percent by excluding commuting time as a program expense.

- Utilize existing Satellite communication capability at MAC to interact with other scientists, educational institutions and clientele groups.

- Minimal disruption of ongoing research by a one-time move. Renovation at Phoenix (Options 1 or 2) would require 1 to 2 years downtime due to moving in and out of temporary space. Such temporary space is not readily available.

- Provide state-of-the-art facilities.

Option 4: All programs currently conducted at Phoenix could be carried out in California and/or Texas. There would be minimal disruption of ongoing research by a one-time move and ARS facilities to be occupied in California and Texas would be state-of-the-art. However, it is likely there would be strong industry, university, and employee opposition to the relocation outside of Arizona. We would anticipate some loss of staff in this proposed transfer.

In the case of both Options 3 and 4, proceeds from the sale of the existing 12 acres of land and real property improvements at Phoenix could be used, if congressionally authorized, towards the development of new facilities and the relocation of staff.

The Agricultural Research Service concludes that relocation of its Phoenix laboratory facilities and functions to the Maricopa Agriculture Center is feasible with respect to program, cooperator, and user requirements. However, planning and implementation of such a relocation is not feasible based upon current authorizations and appropriations. ARS currently plans to continue to remain at the Phoenix location and will apply existing appropriations to the most essential facility repair and maintenance needs as opportunities permit.

Mr. PASTOR. Mr. Smith asked the question, if that land is sold, can the proceeds from that sale be used to offset the costs of developing the Maricopa site?

Dr. PLOWMAN. Again, that depends on this committee and GSA and what the language is. Sometimes we have had permission to sell government property and utilize those proceeds to relocate. But it would take activity of this committee in appropriation language to be able to do that.

Mr. PASTOR. Thank you, I appreciate it.

Thank you.

Mr. DURBIN. Mr. Walsh?

RESEARCH AT ITHACA AND GENEVA, NEW YORK FACILITIES

Mr. WALSH. Thank you Mr. Chairman. Welcome, thank you for your continual support. Can you tell us what sort of research you are doing at Ithaca at your facility at Cornell University and also at the Geneva Station facility?

Dr. PLOWMAN. Yes. We have two major efforts in New York State, one is at Ithaca and one over in Geneva. As part of the national plant germplasm, we have a plant introduction station at Geneva and the purpose of that is to allow us to bring in germplasm of specific crops that are from that part of the country, that is where the national collection of apples is, for example.

So they are maintained there and available for breeders all over the country that might want to use them to improve the apple crop. So that is a big part of the germplasm program there.

In addition to that we have work——

Mr. WALSH. The Empire apple, which is a combination of apple varieties, was that developed there or was that developed at Cornell?

Dr. PLOWMAN. That is a Geneva-Cornell release. But of course, it used the germplasm that was there.

At Ithaca, we have a program in plant soil nutrition and one in plant protection. We have some host plant resistant work there. Part of the strategy, if we are going to reduce the use of ag chemicals to suppress pests, is to breed resistance into crops. So that is part of the effort there at Cornell.

We have the plant soil nutrition laboratory which looks at the production practices on the farm and traces that through to the consumer. In other words, if we are going to change and modify plants for its end use, then we need to back that whole system up from what we start to do on the farm.

And so that is a part of the purpose of that laboratory. We spend about $3.6 million there on our programs. They are in cooperation with the station at Cornell.

INCREASED PRODUCTIVITY

Mr. WALSH. On the issue of plant soil nutrition, I would like to ask you an off-the-wall question. We have had record harvests this year. It seems that American agriculture, other than drought years, continually produces record harvests. Let me ask you this: Are we putting more inputs into seeds now, such as using both fertilizer and other additives to the soil?

Is it because we are increasing acreage every year? Is it because of new practices that you folks have developed? And does that affect the overall future fertility of the soil?

Dr. PLOWMAN. That is a really complicated question. I could spend a half an hour on that. But briefly, we are so great in production, and we need to be for a lot of reasons. We produce more than we can use in this country. So you have to say: Is that good or bad? Well, it is good in that last year we marketed about $42 billion of our excess. That is about the only big thing I can think of that has helped our balance of trade.

Mr. WALSH. Right.

Dr. PLOWMAN. And so I am glad we can produce that in agriculture. And I think, personally, that we need to continue to do that. The only way a farmer can stay in business is to become more efficient all the time, because the price he gets for his produce doesn't keep up. So he has to use this technology or else go out of business.

A lot of farmers in your area, dairy farmers, have gone out of business in the last 10 years. And you have to ask: Is that good or bad? The ones that have stayed in business, have stayed in business because they have adopted all the new technology and so they can produce now twice as much as they did per cow 10 years ago.

If we didn't develop this technology, we would have a lot more people on the farms and we wouldn't produce as much. But on the other hand, the cost of the food that we buy and eat and can ship overseas would cost us a whole lot more. It is a complicated question.

Mr. WALSH. To what do you attribute the record harvests that we have every year, other than drought years? Can we sustain that? What does that do to overall soil fertility? What does it do to farmers as far as inputs?

Dr. PLOWMAN. It requires a lot of input. We never had a drought in this country that covered the whole country and that is why we don't have shortages. We have shortages in parts of the country sometimes. Out in the Midwest, we had a real problem a couple of years ago because of drought. But some of the other parts of the country did very well. So overall, we didn't have it.

You can attribute big increases in production to a lot of things. You can attribute some of it to fertilizer use, it takes fertilizer to produce crops. These other technologies, pest control, new varieties, all of those things contribute to more efficient production. I guess we feel in ARS that we need to keep pushing the technology. We need to keep doing that. Otherwise, we would still be milking cows by hand.

E. COLI TREATMENT RESEARCH

Mr. WALSH. Obviously this question covers a lot of ground literally and figuratively. So we will talk about that again some other time. My last question is that with the recent problem with E. coli in hamburgers and the deaths resulting and the concern about that, what sort of research are you doing in terms of treating the meat supply for E. coli, and what is your opinion on irradiation as a preservative sort of method?

Dr. PLOWMAN. Let me answer the last one first. If we had an irradiator on the end of every line we wouldn't have any problems like that. And the irradiation is a safe thing to do.

In fact, one of the problems—the only problem I can think about of irradiation is that, if it has been irradiated, you can't tell that it has been. But that is how good and safe it is.

Mr. WALSH. Is there any debate in the scientific community about irradiation?

Dr. PLOWMAN. When you say the scientific community——

Mr. WALSH. I understand that there are a lot of different views and definitions of scientists, but within your organization is there any debate?

Dr. PLOWMAN. There is absolutely no controversy in the U.S. Department of Agriculture or the Food and Drug Administration. It is 100%. So if you want to take care of the problem, you can take care of it quick. But in addition to that we have been doing some things and we have been working on E. coli for some time before this problem came up in Washington State.

We are testing some washing procedures that could be adopted by packing plants, using lactic acid which is just plain old vinegar to wash off and decontaminate meat carcasses from those kinds of organisms.

Mr. SMITH. But you didn't mention that you have an irradiator out at Ames, and it's working successfully.

Dr. PLOWMAN. That's right. At the university, there is an irradiator; and we will see a lot more technology coming because of that program. So we need more investment in the food safety business, the kind of things that we have been doing, even though food is safe.

You know even though we safely eat millions of hamburgers in this country every day, we can't stand even one person dying.

Mr. WALSH. It tends to focus the public's attention on that for a brief time, and then the public goes on to something else.

Dr. PLOWMAN. Food is a safe product, but we need to update methods of detection of contamination. We need to trace back and see if we can do anything in the production process to eliminate the source of contamination in the first place. And we need to look at the process of slaughter and packaging to prevent contamination problems. A string of things that we can do and should be doing.

Mr. DURBIN. Mr. Smith?

DEHYDRATED POTATOES

Mr. SMITH. Dr. Plowman, I am really interested in your presentation. It is always good. You were getting along real well until you got to those flaky potatoes. I was one of those who lived for several months on those dehydrated potatoes that you talked about. I remember looking out of the tent at Clark Field one day, and seeing the line about three blocks long. That was an indication that they had something else. I found out they had fresh potatoes. Somebody had come up from Australia with a plane and a load of fresh potatoes.

Dr. PLOWMAN. You and I speak the same language.

Dehydrated eggs, how did you like those?

Mr. SMITH. And that butter we got from Australia, that was made out of sheep tallow.

I also was one of those who had a bad experience with penicillin. It about killed me. I got six shots of that stuff. I needed it but I was allergic to it. It was egg-based. And it is still egg-based, isn't it? Is anybody doing anything about getting something other than egg-based penicillin?

Dr. PLOWMAN. I just don't know enough about that issue to comment. But there must be someone here who does.

Mr. SMITH. It is still egg-based, I am told.

Mr. DURBIN. Save it for the FDA.

SMALL BUSINESS INNOVATION PROGRAM

Mr. SMITH. Also you didn't mention the Small Business Innovation program. You are interfacing with that, aren't you?

Dr. PLOWMAN. Yes. We have a checkoff from our total appropriation that goes into Small Business Innovation that is handled by CSRS.

Mr. SMITH. Are you getting a lot out of it?

Dr. PLOWMAN. Well, I am just not familiar enough with the individual projects to make a good comment. But Dr. Jordan will be here tomorrow, and that would be an appropriate question.

Mr. SMITH. I am told it is working very well to getting things at universities that bigger ones were never able to deliver before. But I will ask that tomorrow.

AMES NUTRITION CENTER

The nutrition center out in Ames is different than other nutrition centers. It is trying to design foods that people will like, that they need, instead of just education, telling you you ought to have a different food, even though you don't like it.

What do you have to say about that?

Dr. PLOWMAN. Well, we have had dialogue with the university people. No one wants to duplicate efforts. We have had a lot of dialogue with them, and they are very interested in what ARS is doing. And we are very interested in what they are doing and hope that we can complement each other.

Mr. SMITH. But you are not doing that anywhere else. At the other five centers, you are trying to educate people to eat foods they don't like because it is better for them. And at this one they are trying to design foods that people like that are better for them.

Dr. PLOWMAN. We have had dialogue with the university. And as a result of knowing what the mission of our laboratories is, they specifically developed a mission to meet a need that we aren't meeting.

Mr. SMITH. That's right. But I keep seeing language coming out of the Department down there as if this was just another one added on to the other five, and it is not.

I mean, you were there at the dedication. You know what the mission is. But I keep seeing language coming out of the Department as if this is just another lab added on to the other five. Have you not seen that or heard that?

Dr. PLOWMAN. I don't know. I haven't participated in the development of that language.

Mr. SMITH. I know you have not. But you got people here from the Department, and I just keep arguing that is an excuse for not wanting to go ahead with this kind of research.

TECHNOLOGY TRANSFER

In addition to that the new administration is going in big for tech transfer. It is great. I am all for it out at the National Institutes of Science and Technology and other places.

But you are doing tech transfer, too. Have you been asked for input on how you can do more tech transfer in your areas since the new administration came in?

Dr. PLOWMAN. We have not had any dialogue with them yet. Mr. Espy has been at some disadvantage in the fact he is the only one there.

Mr. SMITH. He doesn't have help yet?

Dr. PLOWMAN. We need some Assistant Secretaries so that we can dialogue those kinds of things. We are big in tech transfer. That has been a very important issue for us, and we have been pushing that agenda as hard as we can.

Mr. SMITH. What I am afraid of is that they have overlooked the tech transfer component of your programs.

Dr. PLOWMAN. I hope no one is. I reminded this Committee——

Mr. SMITH. It is not the people in this Committee. It is the people in the White House. We have to get the word out that you are in tech transfer, too. And you are right, the Secretary has been at a disadvantage. He needs help. But I hope you will bring this to the attention of those at the Department.

Mr. DURBIN. Ms. Kaptur?

BIODEGRADABLE PLASTIC BAGS

Ms. KAPTUR. Doctor, welcome. And all the gentlemen that you have brought with you. And gentlewomen, I hope.

I wanted to mention something. I was so impressed with your testimony last year and this bag that said "Ohio" on it that I attempted to buy them, and we couldn't find them for sale anywhere a year ago. Does that mean the product is still in development? I couldn't find anybody who was selling them. I was curious, does this mean that they are not ready for market yet, Doctor?

Dr. PLOWMAN. I am going to find out where we got that, and I will let you know in a hurry.

Ms. KAPTUR. I challenge you. Even as a member of this Committee, I called Ohio State, and I was ready to buy several thousand. They lost a market in me.

Mr. TALLENT. There are biodegradable plastic bags made, but the Ohio Corn Growers Association had those made under contract.

Ms. KAPTUR. USDA couldn't tell us that last year.

Dr. PLOWMAN. You asked the wrong person. You should have asked Dr. Tallent.

Ms. KAPTUR. That is why it is good for you to come up here. I thank you very much on that.

LICENSING AGREEMENTS

Doctor, on page 19 of your testimony, you reference some of the license agreements that you signed with food processing plants that transfer your ARS technology. What I would like to know is, do those licensing agreements only go to U.S.-owned firms; or can foreign firms sign licensing agreements with USDA?

Dr. PLOWMAN. Well, I will let Bill help me a bit here. That is his area. But we would rather have technology go to the U.S., no question about that. But there is an instance where a foreign company picked up one of our technologies that we couldn't get anybody in the U.S. to take. But we——

Ms. KAPTUR. Might you mention what that is, please?

Dr. PLOWMAN. It was controlling the sex of livestock.

Now, we had another one, too, on one of the fabrics, the Polytherm fabric. We couldn't get any of the manufacturers in the U.S. to pick it up.

We don't give an exclusive license to a foreign country. Even on the sex determination, we reserved the right to give other licenses in the country if we can get anybody in our country interested in it. And on the one we did on Polytherm, we had some language in it requiring that they license the making and distribution in this country.

Dr. TALLENT. In that instance, the Japanese company did license the patent, and they only got the rights in Japan and some nearby Southeast Asia countries.

But we had the right to come into their plant and see what they were learning as they scaled it up. We were able to bring this available information back; and, as a matter of fact, we have since licensed it to an Iowa firm using some of the technology that we brought back from Japan.

The law says that we have to give preference to firms in the United States, not United States firms but firms in the United States. So a company—ICI, for example, it is a British-owned company but has a major facility in the United States, we can license to them. But we have to give preference to those companies before we go to a company in a foreign country.

Ms. KAPTUR. Thank you for your response. In general terms, what was the problem when you couldn't get a U.S. firm interested? Nobody in the United States was interested in that technology? It cost too much money to develop? It was too long range?

Could you give me a sense of why U.S. firms weren't interested?

Dr. TALLENT. All of the above. The U.S. companies looked at it and just didn't see a quick enough payoff for them. Some of the foreign companies in some instances were willing to take a risk on an enterprise like that that the U.S. companies weren't. We create a paper trail. We make absolutely sure that we have got the documentation to show how hard we have tried to license the patent to a firm in the U.S.

In the case of the sperm separation that Dr. Plowman mentioned, we tried very hard to get some company in the U.S. artificial insemination industry to work with us that—and none of them wanted to take the bait. So there again we have the arrangement

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where the technology may be developed in the U.K. and we can bring it back and market it to the U.S. companies.

Ms. KAPTUR. Who advises you? Attorneys in the USDA?

Dr. TALLENT. Yes, attorneys in the USDA advise us.

Ms. KAPTUR. So you don't work with the Commerce Department?

Dr. TALLENT. In the technology transfer community within the government, there is an interagency group that meets approximately monthly. The Department of Commerce has the lead in it. We discuss these kinds of problems in the interagency forum to be sure that all government agencies are handling them in the same way.

PUBLIC RELATIONS

Ms. KAPTUR. Thank you very much, Doctor.

I wanted to ask, when Secretary Espy was up here, he talked about one of his first initiatives being to consolidate and coordinate the public relations people within the USDA, of which there were several hundred, and they weren't all being coordinated in any one way by the Department.

Others may have asked questions about this. But I particularly enjoyed your testimony today and in fact I am going to send it out with a little note to newspapers in my District why the research that is done and paid for by the taxpayers is important in the area of agriculture.

I still get questions from constituents asking, why are we involved in honey bee research. The sort of thing that comes out over television, and ARS takes a bad rap. As the Secretary reorganizes the efforts of the Department, are you being consulted as to what could be done to deliver a positive message as well?

We don't have a lot of citizens who have a background in science, and they think that all of these things can be done magically elsewhere. I am curious whether you are plugged into the public relations efforts of the Department.

Your testimony is one sign that you are doing something differently, but I am curious who is sending out the positive message there in ways that average citizens can understand.

Dr. PLOWMAN. Well, in terms of the reorganization, Mr. Espy has addressed that issue. There is a group working right now. He has convened all of the public relations personnel of the agencies, and they are working with the Department Public Relations people to see how they can coordinate and reorganize to do a better job in that. That is an ongoing dialogue.

Ms. KAPTUR. Are there people from ARS that are part of that dialogue?

Dr. PLOWMAN. The head of our public relations, Bob Norton, is participating in that.

Ms. KAPTUR. Why do we only hear negative things about blueberry research? Do I assume that the Department sends—could you give me a sense of why——

Dr. PLOWMAN. Well, we just don't put enough investment into doing that kind of thing. In ARS we do some positive things.

I hope the committee—if you are not on our mailing list, I will be disappointed—is receiving our magazine. We publish a magazine

every month called the Ag Research Magazine, and it's very good reading for the public.

This issue here featured, on the cover, the soybean ink, for example. I hope that you are all getting this. Every month we have a number of news releases that we try to get out all over the country. But it is my opinion that the Department just does not put enough investment into saying all the good things that happens and why agriculture is important to the consumer.

Ms. KAPTUR. You know, Doctor, with 600 PR people, a thousand PR people, it is a hard thing for us to—I mean, the entire Congress, including all of our maintenance staff, would fit into one wing of the Agriculture building. So it is hard for someone in our position, we who are out there campaigning all the time trying to get the message across to the public. I sure don't have 1000 public relations agents. I hope this package is sent to all members of the Congress and put that magazine on the top, but I am not sure that Congress is always your problem. I think it is the media and that there ought to be an effort made there to help educate ABC, NBC, CBS. I would go after every one of those.

You know what I did one time? A reporter said negative things about the auto parts industry in my district, I took auto parts and mailed him a package of information and tried to sensitize him. You have to work at these reporters just as you do Members of Congress. I would suggest that there is a better way to get your messages out, and I hope that you put more emphasis on this than in the past.

It is a commitment in personnel. Because obviously there is personnel there. It is what they are doing with their time and how they bring their message to the public.

I thank you for listening.

AQUACULTURE RESEARCH

Have you done any research within ARS on aquaculture in northern climates?

Dr. PLOWMAN. Most of our aquaculture is in the southern climates except for a small effort in West Virginia and I don't know if you want to argue whether West Virginia is north or south, but the species that we are working with is a northern species. We are working with trout there. Most of our other work is with catfish and so on. ARS is not big in aquaculture except with a few laboratories in the south.

Ms. KAPTUR. I would ask your help, because I come from the shallowest part of the Great Lakes system, Lake Erie, the Western Basin, and I know it is also the warmest and the most productive. We get thousands of fishermen, fishermen and women from around the world, and we don't have enough fish; and, of course, we have the quotas with Canada and so forth.

We need to find a way to somehow produce a product either to seed the lake or at least to satisfy the commercial needs in the region, especially perch, pickerel, or things that would be similar to that that appeal to people's taste in the region.

I would love if you could find someone in your Department that could contact me to deal with the issue of aquaculture in a situation such as ours.

Dr. PLOWMAN. The Fish and Wildlife Service, in the Department of Interior is your best source. They deal in the area of sports fishery activities.

They probably would be, hopefully, better to answer your concerns than we would. Because of our mission, we just have never gotten into those kinds of things.

Ms. KAPTUR. I would still like to talk to someone in your agency who deals with aquaculture.

Dr. PLOWMAN. We would be glad to provide some information for you.

GREENHOUSE CROPS RESEARCH

Ms. KAPTUR. For the record, I would ask you to provide information about research efforts underway on greenhouse crops. I have the largest greenhouse producing county in Ohio in my district, and I am interested in work that you are doing in this particular area, in whatever its form, engineer conservation, new water technologies, whatever it is.

Dr. PLOWMAN. We will provide that for you.

[The information follows:]

GREENHOUSE CROP RESEARCH

ARS research related to greenhouse crop production is conducted at three locations. At Beltsville, Maryland, the research is focused on determining the effects of environmental stress factors such as UV-B radiation, elevated CO_2, and temperature on plant growth and key physiological and biochemical processes. Research is also conducted on identification of mechanisms that control adaptation to environmental stresses. At Tifton, Georgia, research is conducted on the development of automated systems to grow and sort seedlings in greenhouses; to detect and evaluate seedlings at various times during their growth in the greenhouse; and to fill shipping modules with single seedlines for transplants. At Wooster, Ohio, we have research on the influence of air flow and microclimate on greenhouse crops and improved methods of application of pesticides which relate to greenhouse and other economic crops.

TOBACCO RESEARCH

Mr. DURBIN. One last question that I forgot to ask in the first round. We have information that indicates that your agency conducts research on what is designated as health and related research concerning tobacco.

What is that?

Dr. PLOWMAN. I was afraid you were going to ask that. We still do a little tobacco research in a couple of areas. As we classify it—we classify our work according to the crop that we work on.

Tobacco is an interesting crop. It is like a white mouse. A lot of biotech that we have done on moving genes around, has been done with tobacco as a model crop. That accounts for part of the work. And I fully support that. It is like a white mouse in medicine.

We do some other work with some other objectives. We have one station down south, that still deals with some tobacco production problems. We have been looking at some alternatives use for the tobacco plant. Tobacco has some interesting proteins in it; and if

we could capture those—it might prove to be an alternative crop for that purpose. So we have been looking at that.

Mr. Durbin. I don't have the scientific background to differentiate, but it strikes me that we should make a distinction between tobacco that has this model crop technique or white mouse aspect to it and that research that is being done for the tobacco industry to make their product more commercially acceptable, which I frankly find totally unacceptable for us to be doing.

You have budgeted $5,318,000 for health and related research in connection with tobacco, please discuss this research in greater detail.

Dr. Plowman. We estimate that our total budget for tobacco research in fiscal year 1993 will be $5,070,900. Of this amount we estimate that $2,274,700 will be obligated for research using the tobacco plant as a model plant system, $1,678,200 for health related research, and $1,118,000 for research to improve efficiency of commercial tobacco production.

ARS research, using the tobacco plant as a model plant system, has direct application to research on other agricultural crops as well. We use the plant to study the physiology and biochemistry of plant growth and to better understand the molecular basis of important plant functions. This includes research on the influence of heavy metals on plant stress and the molecular regulation of photosynthesis—the process by which plants make carbohydrates from water and carbon dioxide of the air. Our scientists are using the tobacco plant to study the synthesis and regulation of amino acids which are the building blocks of producing proteins and other agriculturally important compounds. ARS scientists are conducting research on gene transfer systems and the development of whole plants from tissue culture. Tobacco is one of the few plants where you can regenerate a whole plant from a single cell. We also are using the tobacco plant to study plant defense mechanisms against bacterial and fungal diseases. All of this research helps to provide a better understanding of how plants grow. It also helps to provide insight on how to regulate yield and quality characteristics of agriculturally important crops needed for domestic consumption and export.

The ARS health related tobacco research is concerned with reduced use of pesticides rather than with the health issue of tobacco smoke. Our scientists are using tobacco and tobacco species to screen for biologically active natural products for potential use as biosafe chemicals for control of insects, diseases, and other agricultural pests. We have research programs on insect host-plant interactions and the development and the implementation of pest management systems to reduce use of pesticides. We have a program specifically for the development of biological control procedures for foliar diseases of tobacco. We have a program to study tobacco genetics and the development of improved tobacco germplasm with resistance to insect and disease pests. We also are studying the water movement of chemicals applied to tobacco fields to determine the impact on ground water quality.

Other ARS tobacco research is directed to improving efficiency of commercial production. We have a program on the acquisition, maintenance, and distribution of tobacco germplasm as we have with all major crop plants. ARS scientists conduct genetic studies on tobacco and are trying to develop improved germplasm lines to increase production efficiency and improve physical and chemical qualities. Our scientists are working on a computer model to help predict tobacco yields and quality. They also are working on biological and chemical control of tobacco products in storage. In addition, we have been directed by Congress to provide funds to the University of Kentucky for tobacco research, some of which is being used to support production research.

Mr. DURBIN. By location, what is the budget for health related research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The ARS budget for health related tobacco research by location and fiscal year will be provided for the record.

[The information follows:]

Location	FY 1992	FY 1993	FY1994
Athens, GA	$1,043,900	$933,100	$945,300
Tifton, GA	41,400	41,400	41,900
Lexington, KY	222,900	218,400	221,300
Beltsville, MD	276,300	175,400	177,700
Oxford, NC	310,000	309,900	314,000
Total	$1,894,500	$1,678,200	$1,700,200

Mr. DURBIN. You also have $3,392,700 budgeted in fiscal year 1993 for research that is not health related. How are these funds being used?

Dr. PLOWMAN. In fiscal year 1993, ARS plans to obligate $3,392,700. Of this amount, $2,274,700 is for research using the tobacco plant as a model plant system and $1,118,000 is for research to improve efficiency of commercial tobacco production.

Mr. DURBIN. By location, what is the budget for non-health related research for fiscal years 1992, 1993, and 1994?

Dr. PLOWMAN. The ARS budget for non-health related tobacco research by location and fiscal year will be provided for the record.

[The information follows:]

Location	FY 1992	FY 1993	FY 1994
Albany, CA	$221,800	$116,200	$117,700
Lexington, KY	1,227,300	1,219,000	1,235,000
Beltsville, MD	552,800	434,800	440,500
Oxford, NC	1,621,500	1,622,700	1,644,000
Total	$3,623,400	$3,392,700	$3,437,200

Mr. DURBIN. Thank you. Mr. Skeen, did you have another question?

AMERICAN INDIAN TRIBAL COLLEGE

Mr. SKEEN. Dr. Plowman, precedent seems to exist for colleges serving special populations; for example American Territories and

Historically Black Colleges are eligible for ARS Research Grants, while American Indians are excluded. Why have the American Indian Tribal Colleges been left out?

It is my understanding that Secretary Espy could add the American Indian tribal colleges as eligible applicants under the ARS Special Grants. Do you believe American Indian tribal colleges should be eligible applicants for these grants?

Dr. PLOWMAN. This question can be answered best by the Cooperative State Research Service which operates the Special Research Grants program. However, we do enter into collaborative research agreements with some colleges and universities. The American Indian Tribal Colleges are not precluded from developing and submitting proposals for collaborative research.

Mr. DURBIN. I would like to thank this panel very much. It was an excellent presentation, and we are always happy to have you, not just because of your good testimony but because of the grocery bag that you bring. We will be inviting you back for a separate hearing on genetic engineering and food. You and I have discussed this. We are going to try to bring together FDA and people from USDA to have a little bit of a discussion about where this is heading. Thank you.

ESSEX E. FINNEY

Essex E. Finney is Associate Administrator of the Agricultural Research Service (ARS), U.S. Department of Agriculture. This is the number two position in the Agency. ARS is the principal in-house research agency of the Department of Agriculture. Research is carried on at 122 locations in the United States and in five foreign countries. Over 2500 Ph.D. level scientists carry out a comprehensive program of basic and applied research in areas on natural resources and environmental quality, plant and animal productivity, developing new high quality products to expand the markets for agricultural commodities, and human nutrition requirements to maintain optimal health and well being. Prior to his appointment as the ARS Associate Administrator in 1992, Finney was Director of the Beltsville Agricultural Research Center where he also served as Assistant Director (1977-83) and Associate Director (1983-87). He also served as Associate Director of the ARS 12-State North Atlantic Area from 1987-1989. He received a Ph.D. from Michigan State University in 1963 and was a Princeton Fellow at the Woodrow Wilson School of Public and International Affairs, Princeton University, 1973-74. He served as a Senior Policy Analyst during 1980-81 in the Office of Science and Technology Policy, Executive Office of the President.

AGRICULTURAL RESEARCH SERVICE

Statement of Dr. R. Dean Plowman, Administrator, Agricultural Research Service, United States Department of Agriculture, before the Subcommittee on Agriculture, Rural Development, Food and Drug Administration, and Related Agencies.

Mr. Chairman, and members of the Committee, we in the Agricultural Research Service (ARS) appreciate this opportunity to discuss our mission and how we manage our research program. As the principal scientific research Agency of the U.S. Department of Agriculture, our mission is to develop new knowledge essential to solving technical agricultural problems that are broad in scope and have high national priority. We are a problem-solving Agency that is dedicated to sustaining a viable food and agriculture economy -- to maintaining a quality environment -- and ensuring affordable, abundant, safe, good quality food and fiber for the Nation's consumers. At the same time, we want to make sure that our farmers and ranchers remain competitive in both the domestic and world markets.

Federal Agricultural Research

At this point Mr. Chairman, one might ask the question -- Why does the country need a Federal agricultural research agency? Why can't universities and other public and private institutions fulfill this need?

The short answer to that question is that ARS does research that requires unique national facilities, is national in scope, meets immediate emergency requirements, or is in the long-range national economic interest. This is research that other institutions cannot or will not do because of the expensive facilities, lack of a national network, inability for quick mobilization, or the long-range and uncertain pay off.

Examples of unique and expensive facilities required are those such as for exotic animal disease research at Plum Island, NY, the cotton processing research at the Southern Regional Research Center in New Orleans and the ARS ginning laboratories at Stoneville, MS, Lubbock, TX, and Las Cruces, NM. Recent efforts pertaining to sweetpotato whitefly show our ability to respond quickly to a critical problem. The industrial use research conducted mainly in the ARS regional research centers in the 1950's and 1960's is an example of long-term, high-risk research that has had a continuous and increasing pay off. Virtually all of the products (including potential new crops) being promoted as part of the new emphasis on alternative agriculture had their genesis in the early ARS industrial use program. On a broader scale, a recent sampling by a highly reputable consulting firm of 87 research projects from the many completed in the total ARS program in the 1980-1990 decade showed an economic pay off of $14.3 billion.

ARS also provides continuity of research resources needed to facilitate the development of solutions to the complex problems we investigate. Furthermore, the long-standing, inhouse research organization plays a pivotal role in providing leadership and focus to the Nation's total agricultural research. This is analogous to the national research direction that the National Institutes of Health provides for biomedical research nationwide.

Let me cite a few more specifics. ARS carries out focused, priority research to address national or broad regional problems. A bit later I will discuss in more detail the management structure of the Agency and our program plan, but the research is directed nationally and internationally as no other organization can. Its interests and responsibilities go beyond political and geographical boundaries. It is responsive to the Secretary, the President, other Executive Branch agencies, and the Congress to meet new or expanded needs they deem priority. The USDA's inhouse resources -- its laboratories, equipment and its cadre of multidisciplinary scientists -- provide a ready capability to immediately attack urgent problems as demonstrated by the recent outbreaks of TCK Smut, Russian Wheat Aphid infestations and, Bovine Tuberculosis. For example, as recently as this past weekend ARS dispatched a scientist from Frederick, Maryland, to the People's Republic of China (PRC) to negotiate with the Chinese on the identification of TCK Smut spores that are allegedly contaminating a U.S. wheat shipment embargoed at a

Chinese port. A U.S. Federal scientist is crucial to these and other international technical negotiations because many foreign governments will only honor the credibility of such national experts. The TCK Smut identification technology has emerged as a result of four years of cooperative research between scientists of ARS and the PRC.

A significant part of the ARS research program is in response to critical Federal regulatory requirements of EPA, FSIS, APHIS, DOD, SCS, FGIS, and others. This includes issues dealing with regulations that affect commodity exports and imports like the banning of methyl bromide which will have an immediate and devastating economic impact on many countries, not only the U.S., but many developing countries. We're currently investigating alternative treatments to replace methyl bromide fumigants for selected commodities. ARS is involved in many regulatory and health issues dealing with Salmonella, E.coli, avian leucosis and so on. These are national issues that impact producers and consumers alike. There is no one other research organization with the experience, knowledge and capability to step-up and respond quickly to these issues. The USDA's inhouse research must coordinate and carry out these and similar programs that a State cannot undertake.

A large and significant part of the ARS mission deals with the National genetic resources program. The Agency conducts plant

explorations, collects and maintains plants, insects, fungi and microbial collections. ARS carries out research to enhance these collections. It maintains plant introduction stations and other laboratories to protect and preserve our germplasm. The largest collection of seed is maintained at our National Seed Storage Laboratory in Ft. Collins, Colorado.

Our biological control programs are carried out at a number of ARS locations here and in our foreign laboratories in France, Argentina and Korea. Foreign explorations are pursued by our scientists to further our biocontrol research which ultimately will lessen our reliance on chemicals.

ARS carries out research for the Nation, where profit is not a motivation; research that is not feasible for others to conduct. For example: the Agency carries out research at a number of national laboratories like the foreign animal disease laboratory at Plum Island, whose mission is to safeguard the Nation's meat-food industry from financial devastation should an exotic disease like Foot-and-Mouth enter our borders. We are co-located with the veterinarians of APHIS on this Island. We are also co-located with APHIS personnel at our National Animal Disease Center at Ames, Iowa where we jointly coordinate our efforts to reduce and eradicate diseases and pests of our farm animals. Our utilization laboratories continue to play a vital role in finding new uses for food and non-food products and processes.

Their contributions from the 1950's and 1960's are still impacting our everyday lives.

Our utilization laboratory at Peoria, Illinois pioneered research to find industrial uses for agricultural commodities and continues to carry out an outstanding program. The Eastern utilization laboratory has found solutions to many food safety and health issues; our utilization laboratory in New Orleans has solved problems for our cotton farmers and industry from picking it to manufacturing a permanent press shirt.

Budgetary Resources

The Agricultural Research Service's budget in FY 1993 is $660,879,000. These funds are allocated for priority research needs of the Nation's agricultural producers and consumers. Programs are targeted toward environmental concerns and sustaining natural resources such as groundwater quality, waste management and biocontrol programs; food safety programs to address Salmonella, bacteria, Listeria and other concerns; human nutrition research is directed toward the young, the aged, and on diet and its relation to cardiovascular diseases, cancer and other chronic illnesses; genetic resources research activities are pursued to ensure that a full complement of genetic diversity is available to improve our plant and animal materials; international trade and economic prosperity are targeted through new uses of agricultural commodities, developing alcohol fuels

and improving production efficiencies etc. I could go on in much more detail but I need to stress that the research we direct is in response to the Nation's highest priorities for agricultural research.

In order to maintain our responsiveness to emerging issues that arise, we direct and redirect our resources as necessary. We manage our programs to meet new or expanded research issues within available resources. However, if we are to remain an effective research organization we will need to seek additional resources to maintain our core programs and improve our facility infrastruction. The Agency has undertaken the effort to upgrade and modernize a number of its national and regional research centers -- many of which were built in the 1940's. This must be done to protect these Federal assets from deterioration; to provide available state-of-the-art laboratories as required by regulatory standards, and for health and safety requirements.

In testifying today I want to emphasize at the outset that the Administration is currently formulating the President's FY 1994 Budget. Accordingly, I am not in a position to provide you with the Administration's position on funding for specific programs or activities. As soon as the President's FY 1994 Budget is released I would be pleased to provide you with the Department's views.

Program Plan

A scientific/technological revolution for agriculture appears to be underway. The potential is great for major scientific breakthroughs in the agricultural sciences led by new developments in biotechnology and computer/information systems. To realize this potential, ARS has a strategic plan for guiding the agency into the next century and beyond. This plan identifies the long-range challenges to U.S. agriculture and the approaches ARS would use to meet them. Policies are also established to guide the agency over a six-year period and each successive period thereafter.

The plan enables the agency to systematically review priorities, address new needs, and develop approaches to be used for meeting the challenges that are possible within available funding. Our National Program Staff consists of experts from a wide range of science. This staff is responsible for overseeing ARS research programs, establishing broad priorities to guide resource implementation, and ensuring national coordination. A geographically dispersed chain of management responsibility starts with the Administrator and extends out to area/center directors and on to research leaders at our locations. Research leaders at these locations have front-line responsibilities for carrying out the programs and efficiently managing the resources allocated to them. Through this structure, ARS can respond quickly to mandates of Congress or the Executive Branch, to

emergency situations of national importance, or to critical needs of regulatory agencies. A substantial part of the research conducted by ARS is fundamental in nature but still directed toward solving problems that require long-term, high risk approaches. To conduct this kind of research, ARS scientists use the most advanced technologies known. Much of it is on the leading edge of each discipline that is required. Equally important is the applied research ARS carries out to attack more immediate problems facing farmers, producers and consumers.

Research Facilities

ARS has 122 domestic research facilities and 5 foreign laboratories strategically situated across the major farm and range ecosystems and climate zones of the U.S. to respond to critical needs facing American agriculture. Many of the facilities are located on university campuses and State agricultural experiment stations which assures cooperation and interaction with State scientists. This arrangement encourages joint use of expensive equipment and support facilities. The facilities in the foreign countries enable scientists to conduct research that is of direct benefit to U.S. agriculture and prevents problems from being introduced, some of which would be catastrophic. ARS facilities range from those designed to address specific problems such as the U.S. Grain Marketing Research Laboratory in Manhattan, Kansas to large centers like the Beltsville Agricultural Research Center that provide for

multidisciplinary research. Many aspects of agricultural research are carried out at the major ARS research centers located at Beltsville, Maryland; and Athens, Georgia; and the Regional Utilization Research Centers at New Orleans, Louisiana; Peoria; Illinois; Albany, California; and Philadelphia, Pennsylvania.

Human nutrition research is focused at five major ARS research centers: Beltsville, Maryland; Grand Forks, North Dakota; Houston, Texas; Boston, Massachusetts; and San Francisco, California. Each center has specific goals and objectives to promote optimum human health and well-being through improved nutrition which will be essential in reducing the long-term health care costs of the Nation. Major centers which have been established to meet national research needs also include the U.S. Meat Animal Research Center, which is located at Clay Center, Nebraska and focuses on production research problems facing the U.S. livestock industry; the Plum Island Animal Disease Center which is located off Long Island, New York and carries out research on foreign animal diseases; and the National Animal Disease Center located at Ames, Iowa which conducts research on diseases of national importance in cattle, sheep, swine, and horses. There are other national research facilities as well as those addressing regional research problems which serve a unique clientele.

Technology Transfer

To help translate the results of our research into practical products, processes, and services, ARS has worked closely with commercial firms for many years.

With passage of the Federal Technology Transfer Act of 1986, ARS has taken the lead in the number of agreements made with the private sector to move research from laboratories and putting it to use. ARS has over 290 Cooperative Research and Development Agreements (CRADA's) with private firms to commercialize new technology and stimulate new business enterprises. This has included a variety of technologies addressing contemporary concerns such as food safety, biological pest control, and product quality -- even veterinary medicine. ARS in 1992 received a National award from NASA for pioneering the transfer of new technologies to the private sector.

Agricultural Science

As you know, we're blessed with an abundant supply of high-quality food in our country. Preliminary 1992 figures show record yields for corn, soybeans, grain sorghum, barley, oats, Durum and other spring wheat. Cotton and rice yields are the second highest ever. It's fortunate that we're producing more, because consumers have an ever-growing appetite for food: people spent a record $462 billion on food raised on U.S. farms in 1991. The U.S. generated about $42 billion dollars in agricultural

exports last year -- a new high. There's no reason to think the demand for food will decrease.

The share of the average American family's disposable income used for food has dropped steadily from 22 percent in the 1950's to just over 11 percent today. There are a lot of reasons for this. A key factor -- and one that is often overlooked -- is the quality of our agricultural science. Behind every product that a farmer produces and a grocery store sells, there is a substantial research investment. We sometimes take our food supply for granted, but this does not happen by chance; a lot goes into producing it. Farmers can work from dawn to dusk, but they won't be able to produce enough over the long term -- at affordable prices -- if they don't conserve their soil and water, plant hardy varieties, control insects and diseases and transport their crops quickly to the marketplace.

The impact of research on our food supply is often subtle. As consumers, we see the end product; when we buy seedless grapes in the produce department, we don't realize that plant breeders worked years to develop that variety. We're not always interested in how the product evolved. We just want it to be available, safe, nutritious and affordable.

ARS Accomplishments

To illustrate the impact of research on our food industry and daily lives, I thought I'd take you through the day of an American consumer, focusing on some of the many products that ARS research has helped create. These products aren't limited strictly to food, because our researchers have developed many new non-food uses for agricultural commodities.

Let's start at the beginning of the day with a glass of orange juice for breakfast. ARS scientists at the Winter Haven laboratory in Florida in the 1940's developed a technique for making it from frozen concentrate. Even if you eat a fresh orange in the morning, chances are that it is a variety developed in whole, or in part, by ARS breeders. If you prefer, say, apple or grape juice, our scientists also developed processes for making those juices from concentrate and techniques to insure their quality and that they are free from adulteration. In fact, almost any frozen food you eat has an ARS imprint: our scientists at the Western Regional Research Center in Albany, California helped spawn the frozen food industry by developing ways to blanche and freeze fruits, vegetables and other products while retaining their flavor, texture and nutrients.

Maybe you're going to have a bowl of cereal and milk with your juice. That's not easy for much of our population that has trouble digesting a milk sugar called lactose. Our scientists at

our Philadelphia laboratory discovered a practical way to remove lactose to make it possible for lactose-intolerant people to digest milk and other dairy products that provide valuable calcium, protein and other nutrients in our daily diets.

Now you're ready to read the morning newspaper. In some parts of the country, the ink, particularly color inks, has been made from soy oil instead of petroleum oils. Our scientists at Peoria, Illinois markedly improved that technology to expand this new use for soybeans, which is good news from an environmental and agricultural standpoint, providing a new use for soybeans and a source of ink from a renewable source. In early 1991, estimates were that soy-based ink used 5 to 10 million bushels of soybeans yearly. If all printers converted to 100 percent soy ink, it would consume about 100 million bushels. This is a new use for an agricultural commodity that expands the market, enhances the returns to the farmer, and expands business opportunities in rural communities.

It's also likely that, in coming years, that newspaper will be printed on paper made from a crop called kenaf, which our scientists have been studying as an alternative source of pulp for paper products. Plans are underway for the first commercial plant to make newsprint from kenaf.

You're finished with breakfast and caught up on the news, and you're ready to get dressed. If you're wearing cotton, wool or leather clothing, chances are it was made with the help of technology developed by ARS. Our researchers at the Southern Regional Research Center in New Orleans helped develop wrinkle-resistant, durable cotton fabrics.

One type of cotton, Pima which has extra-long fibers, has been genetically improved by ARS and is being grown more and more because of its increasing use in luxurious consumer fabrics. They also found a way to make shrink-resistant wool and higher-quality leather by improving tanning and other steps that turn animal hides into leather.

In the event you have a condition requiring medication, your physician might prescribe penicillin or a similar antibiotic. Many Americans don't realize that ARS scientists, during World War II, developed a technique for mass-producing penicillin so it could be available on a large-scale basis for our soldiers. Our scientists also discovered a more productive strain of the *Penicillium* mold that produces penicillin. The entire antibiotics industry is based on the fermentation technology developed by ARS for penicillin.

There may also be some ARS research in the car you drove to the office. The absorbent starch-material in your fuel and oil

filters was developed by ARS scientists. Most fuel and oil filters contain a new starch-based dewatering absorbent. This absorbent derived from corn and developed by ARS scientists is known to many as Super Slurper. It is used in a variety of other products from disposable diapers and baby powder to coatings on the seeds you plant in your summer garden.

Are you ready for lunch? If you're eating mashed white potatoes or sweetpotatoes from flakes, ARS scientists developed that technology, and, like our frozen food research, it helped spawn an industry -- today 400 million pounds of potato flakes are produced each year in our country. If you're having a sandwich for lunch, the bread's quality has been helped by ARS research to improve the baking properties of wheat flour. Peanut butter, popular on sandwiches, has better flavor and quality today than it did years ago, partly due to ARS research. If you like sourdough bread, you can thank ARS researchers -- in the 1960's they identified the bacterium and yeast that work together to produce the sourdough bread in the San Francisco area. Now it can be baked anywhere in the world.

For dinner, you're having a salad. The lettuce, the tomatoes -- almost any vegetable in it is probably a variety that was improved by years of ARS breeding research. More than 90% of all lettuce grown and consumed in the U.S. is the iceberg lettuce type, derived from ARS research at our Salinas, California

laboratory. If you use a dressing with vegetable oil, it probably contains some soybean oil. Its quality has been greatly improved over the years by ARS research. In fact, our soybean research has helped transform it from a little known crop in the 1950's to the second biggest in the country today. Soybeans can be found in a variety of products today -- from vegetable oils to margarine, breads, pastries, cakes and muffins.

As in vegetables, ARS research is incorporated into much of the fruit you eat today. Over the years, ARS researchers have improved everything from citrus to strawberries and blueberries. As I mentioned earlier, if you like Flame seedless grapes, you can thank ARS researchers at our Fresno, California laboratory who developed them.

The ARS imprint is also in the turkey you're having for dinner. Our scientists bred the "Beltsville Turkey," predecessor to the modern turkey, which is quite an improvement over the wild turkey the Pilgrims ate at their first Thanksgiving. The corn the Native Americans presented to the colonists has undergone a significant transformation over the years -- helped greatly by ARS corn breeders. Most recently, in 1992 ARS released two corn germplasm populations that have resistance to aflatoxin, a potent carcinogen, and to fall armyworm insect pests.

And, speaking of holidays, the poinsettias that often decorate homes and offices are partly the result of ARS breeders who helped make improvements in the color of the leaves and their longevity. The scientific basis for using variable day lengths and artificial lighting to regulate the timing of flowering has provided the foundation for the entire floral industry as we know it today. These are just a few of many advances our scientists have made over the years in ornamental and floral plants.

In addition to turkey, most of the meat and poultry that you eat has been improved by ARS researchers. We've improved the taste and texture of the meat, and our scientists have helped develop tests to safeguard food from contamination by organisms that cause botulism, Salmonella and other types of food poisoning. Our researchers have also bred new and improved farm animals, and developed vaccines to protect their health. One of those vaccines, to prevent coccidiosis in chickens, was the subject of the first CRADA with a private company under the 1986 Technology Transfer Act.

If you're taking an evening walk after dinner, you may encounter a mosquito along the way. Our researchers have developed repellents for mosquitos and controls for other pests such as cockroaches and fire ants. Much of this research was done by ARS scientists in support of Department of Defense needs in World War II and has continued to current day DOD operations in Desert

Storm and Somalia to protect our troops from biting insects.

Our pioneering technology to eradicate the screwworm insect through mass releases of sterile males produced by irradiation -- an early success in biocontrol -- is now world renowned. Just last year the two ARS scientists who developed this technology were awarded the World Food Prize.

Aside from controlling harmful insects, we're also protecting our most beneficial insect, the honey bee. In January we released a new honey bee strain that has resistance to two mites that have threatened our domestic honey bee industry with serious losses. Maintaining a healthy population of honey bees means they'll continue to help pollinate billions of dollars worth of our crops each year.

These are only some of the examples of products you might encounter on a given day. It would take too long to name them all. But, as you can see, ARS is committed to moving our technology from the laboratory into the marketplace. In 1991-92 our scientists filed 174 patent applications and licensed 56 inventions to private companies -- including a process to grow taxol, the cancer-fighting drug, in cell cultures, rather than relying on the bark from the Pacific yew tree. We also recently signed more than 100 new CRADA's with private companies.

Whether the research results are released by ARS or private companies, the important thing is that they get to the marketplace, so that the public's tax dollars wind up benefitting the people who paid the bill in the first place.

Our challenge is to continue solving problems for agriculture, its producers and consumers, and to the meet food and fiber requirements of a growing population in a way that is safer, better and more nutritious.

Mr. Chairman, that concludes my statement. I would be glad to answer any questions the Committee may have.

AGRICULTURAL RESEARCH SERVICE

Purpose Statement

The Agricultural Research Service was established on November 2, 1953, pursuant to authority vested in the Secretary of Agriculture by 5 U.S.C. 301 and Reorganization Plan No. 2 of 1953, and other authorities.

The research performed by the Agricultural Research Service (ARS) is authorized by the Department of Agriculture Organic Act of 1862 (7 U.S.C. 2201, 2204), the Research and Marketing Act of 1946, as amended (7 U.S.C. 427,1621), the Food and Agriculture Act of 1977, as amended (7 U.S.C. 1281 note), the Food Security Act of 1985 (7 U.S.C. 3101 note), and the Food, Agriculture, Conservation, and Trade Act of 1990 (7 U.S.C. 1421 note).

The Agricultural Research Service is responsible for conducting mission-oriented research on:

--Soil, Water and Air Sciences
--Plant Sciences
--Animal Sciences
--Commodity Conversion and Delivery
--Human Nutrition
--Integration of Agricultural Systems

The research applies to a wide range of goals; commodities; natural resources; fields of science; and geographic, climatic and environmental conditions.

As the U.S. Department of Agriculture's in-house agricultural research agency, ARS has major responsibilities for conducting and leading the national agricultural research effort. ARS provides initiative and leadership in five areas:

* Research on broad regional and national problems.
* Research to support Federal action and regulatory agencies.
* Expertise to meet national emergencies.
* Research support for international programs.
* Scientific resource to the Executive Branch and Congress.

The mission of ARS research is to develop new knowledge and technology which will insure an abundance of high quality agricultural commodities and products at reasonable prices to meet the increasing needs of an expanding economy and to provide for the continued improvement in the standard of living of all Americans. This mission focuses on the development of technical information and technical products which bear directly on the needs to (1) manage and use the Nation's soil, water, air, and climatic resources, and improve the Nation's environment; (2) provide an adequate supply of agricultural products by practices that will maintain a permanent and effective agriculture; (3) improve the nutrition and well-being of the American people; (4) improve living in rural America; and (5) strengthen the Nation's balance of payments.

Research is conducted at numerous field locations in the States, District of Columbia, Puerto Rico, the Virgin Islands, and in several foreign countries. Much of the work is conducted in direct cooperation with the State agricultural experiment stations, other State and Federal agencies, and private organizations.

Central offices of ARS are in the Washington, D.C. Metropolitan Area. The field activities are managed on a national basis through 8 Area Offices. Activities are carried out at 122 separate field locations. As of September 30, 1992, there were 6,902 full-time employees and 2,109 other than full-time employees. Of the total, 496 full-time employees and 26 other than full-time employees worked in the headquarters office.

AGRICULTURAL RESEARCH SERVICE

Available Funds and Staff-Years

1992 Actual and Estimated, 1993 and 1994

Item	1992 Actual Amount	1992 Actual Staff-Years	1993 Estimated Amount	1993 Estimated Staff-Years	1994 Estimated Amount	1994 Estimated Staff-Years
Direct Appropriation:						
Agricultural Research Service	$660,781,000	8,169	$660,667,000	7,992	$675,951,000	7,955
Buildings and Facilities	65,564,000	--	34,514,000	- -	24,587,000	
Total, Appropriation	726,345,000	8,169	695,181,000	7,992	700,538,000	7,955
Deduct Allotments to Other Agencies:						
Forest Service	-357,686	- -	-361,000	- -	-361,000	--
Net	725,987,314	8,169	694,820,000	7,992	700,177,000	7,955
Allocations from:						
Hazardous Waste Mgmt.	5,209,691	--	1,698,000	--	1,248,000	--
Reimbursement from other USDA Appropriations:						
Agricultural Marketing Service	207,896	1	208,000	1	204,000	1
Animal and Plant Health Inspection Service	8,411,721	56	8,412,000	56	8,268,000	50
Federal Grain Inspection Service	532,697	2	533,000	2	524,000	2
National Agricultural Library	424,324	2	424,000	2	417,000	1
Forest Service	1,177,404	3	1,177,000	3	1,157,000	3
Food Safety and Inspection Service	1,841,550	3	1,842,000	3	1,811,000	3
Extension Service	97,585	1	98,000	1	96,000	1
Office of Energy	56,583	1	57,000	1	56,000	1
Office of International Cooperation and Development	605,656	2	606,000	2	596,000	2
Soil Conservation Service	496,109	2	496,000	2	488,000	2
Cooperative State Research Service	287,764	1	288,000	1	283,000	1
Miscellaneous Reimbursements	106,936	1	859,000	1	844,000	1
Total, Other USDA Funds	19,455,916	75	16,698,000	75	15,992,000	68
Total, Agriculture Appropriations	745,443,230	8,244	711,518,000	8,067	714,921,000	8,023
Other Federal Funds:						
Department of Defense	1,255,954	4	1,256,000	4	1,231,000	3
Department of Energy	481,803	2	482,000	2	473,000	2
Department of Health and Human Services	1,422,187	4	1,422,000	4	1,394,000	4
Department of Interior	1,002,464	3	1,002,000	3	982,000	2
Department of State	522,387	2	522,000	2	512,000	2
Environmental Protection Agency	1,764,788	4	1,765,000	4	1,730,000	4
Nat'l Aeronautics & Space Administration	165,571	1	166,000	1	163,000	1

Available Funds and Staff-Years

1992 Actual and Estimated, 1993 and 1994

Item	1992 Actual Amount	1992 Actual Staff-Years	1993 Estimated Amount	1993 Estimated Staff-Years	1994 Estimated Amount	1994 Estimated Staff-Years
Other Federal Funds (continued)						
Miscellaneous Reimbursement.......	99,095	1	385,000	1	378,000	1
Total, Other Federal Funds...............	6,714,249	21	7,000,000	21	6,863,000	19
Non-Federal Funds:						
State of California..	330,276	2	330,000	2	315,000	2
Binational Agriculture Research & Development Agreement (BARD)...	464,246	3	464,000	3	442,000	2
Quarters and Subsistence.........	190,931	1	191,000	1	182,000	1
North Carolina State University	148,628	1	149,000	1	142,000	1
Cotton Inc.	142,268	1	142,000	1	135,000	1
Florida Department of Natural Resources ..	237,562	1	238,000	1	227,000	1
Florida Department of Environment Regulation..........	100,001	1	100,000	1	95,000	1
Texas A&M Univ.Agric. Experiment Station	117,599	1	118,000	1	113,000	1
Miscellaneous Reimbursement.......	1,465,148	3	2,268,000	3	2,162,000	3
Total, Non-Federal Funds...............	3,196,659	14	4,000,000	14	3,813,000	13
Miscellaneous Contributed Funds..	8,359,132	53	7,645,000	48	7,428,000	45
Total, Agricultural Research Service......	763,713,270	8,332	730,163,000	8,150	734,273,000	8,100

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Agricultural Research Service

Permanent Positions by Grade and Staff-Year Summary
1992 Actual and Estimated 1993 and 1994

Grade	1992 Actual Hdqtrs	1992 Actual Field	1992 Actual Total	1993 Estimate Hdqtrs	1993 Estimate Field	1993 Estimate Total	1994 Estimate Hdqtrs	1994 Estimate Field	1994 Estimate Total
ES-6	1	--	1	1	--	1	1	--	1
ES-5	6	7	13	6	7	13	6	7	13
ES-4	1	12	13	1	12	13	1	12	13
ES-3	1	4	5	1	4	5	1	4	5
ES-2	--	2	2	--	2	2	--	2	2
ES-1	3	14	17	3	14	17	3	13	16
GS/GM-15	48	393	441	48	393	441	48	392	440
GS/GM-14	36	544	580	36	544	580	36	542	578
GS/GM-13	96	710	806	96	710	806	96	706	802
GS-12	102	610	712	102	610	712	102	607	709
GS-11	19	456	475	19	456	475	19	451	470
GS-10	1	18	19	1	18	19	1	17	18
GS-9	15	760	775	15	760	775	15	755	770
GS-8	3	328	331	3	328	331	3	312	315
GS-7	42	677	719	42	677	719	41	675	716
GS-6	98	579	677	98	579	677	98	579	677
GS-5	48	583	631	48	583	631	46	583	629
GS-4	19	263	282	19	263	282	17	260	277
GS-3	2	41	43	2	41	43	2	41	43
GS-2	1	8	9	1	8	9	1	8	9
GS-1	--	3	3	--	3	3	--	3	3
Positions at rates Established by Act June 20, 1958 (U.S.C. 3104) (ST).........	--	12	12	--	12	12	--	12	12
Grades Established under Foreign National Pay Plan Manual..	--	12	12	--	12	12	--	12	12
Ungraded Positions....	2	583	585	2	583	585	2	583	585
Total Permanent Positions....	544	6,619	7,163	544	6,619	7,163	539	6,576	7,115
Unfilled Positions end-of-year	-45	-196	-241	-45	-196	-241	-45	-196	-241
Permanent Employment end-of-year	499	6,423	6,922	499	6,423	6,922	494	6,380	6,874
Staff Years: Ceiling......	524	7,808	8,332	513	7,637	8,150	508	7,592	8,100

AGRICULTURAL RESEARCH SERVICE

CLASSIFICATION BY OBJECTS

1992 Actual, Estimated 1993 and 1994

	1992 Actual	1993 Estimated	1994 Estimated
Personnel Compensation:			
Headquarters	$29,933,400	$31,616,071	32,526,000
Field	271,603,077	286,870,929	295,132,000
11 Total Personnel Compensation	301,536,477	318,487,000	327,658,000
12 Personnel Benefits	61,871,497	65,743,000	67,613,000
13 Benefits for former employees	460,569	--	--
Total Pers. Comp. & Benefits	363,868,543	384,230,000	395,271,000
Other Objects:			
21 Travel and transportation of persons	11,391,768	11,392,000	11,424,000
22 Transportation of things	1,334,368	1,334,000	1,338,000
23 Communications, utilities and miscellaneous charges	28,262,974	28,263,000	28,341,000
24 Printing and reproduction	1,299,662	1,300,000	1,303,000
25.1 Consultant services	209,000	222,000	223,000
25.2 Other Services	144,943,758	132,997,000	129,843,000
26 Supplies and materials	51,724,712	48,118,000	48,251,000
31 Equipment	41,245,286	37,920,000	38,025,000
32 Lands and Structures	62,833,784	86,410,000	48,890,000
41 Grants, subsidies, and contributions	9,715,515	9,716,000	9,742,000
Total Other Objects	352,960,827	357,672,000	317,380,000
Total Obligations	707,113,855	741,902,000	712,651,000
Position Data:			
Average Salary, ES positions	$ 99,324	$103,000	105,000
Average Salary, GM/GS positions	36,202	37,962	39,915
Average Grade, GM/GS positions	9.59	9.59	9.59
Average Salary of Ungraded positions	35,253	36,809	37,426

Note: Includes Salaries and Expenses and Buildings and Facilities Obligations.

PROPOSED LANGUAGE CHANGES

AGRICULTURAL RESEARCH SERVICE

The estimates include proposed changes in the language of this item as follows (new language underscored; deleted matter enclosed in brackets):

Salaries and Expenses

For necessary expenses to enable the Agricultural Research Service to perform agricultural research and demonstration relating to production, utilization, marketing, and distribution (not otherwise provided for), home economics or nutrition and consumer use, and for acquisition of lands by donation, exchange, or purchase at a nominal cost not to exceed $100, [$658,379,000] $666,451,000: Provided, That appropriations hereunder shall be available for temporary employment pursuant to the second sentence of section 706(a) of the Organic Act of 1944 (7 U.S.C. 2225), and not to exceed $115,000 shall be available for employment under 5 U.S.C. 3109: Provided further, That funds appropriated herein can be used to provide financial assistance to the organizers of national and international conferences, if such conferences are in support of agency programs: Provided further, That appropriations hereunder shall be available for the operation and maintenance of aircraft and the purchase of not to exceed one for replacement only: Provided further, That appropriations hereunder shall be available to conduct marketing research: Provided further, That appropriations hereunder shall be available pursuant to 7 U.S.C. 2250 for the construction, alteration, and repair of buildings and improvements, but unless otherwise provided the cost of constructing any one building shall not exceed $250,000, except for headhouses or greenhouses which shall each be limited to $1,000,000, and except for ten buildings to be constructed or improved at a cost not to exceed $500,000 each, and the cost of altering any one building during the fiscal year shall not exceed 10 per centum of the current replacement value of the building or $250,000, whichever is greater: Provided further, That the limitations on alterations contained in this Act shall not apply to modernization or replacement of existing facilities at Beltsville, Maryland: Provided further, That the foregoing limitations shall not apply to replacement of buildings needed to carry out the Act of April 24, 1948 (21 U.S.C. 113a): Provided further, That the foregoing limitations shall not apply to the purchase of land or the construction of facilities as may be necessary for the relocation of the United States Horticultural Crops Research Laboratory at Fresno to Parlier, California, and the relocation of the laboratories at Behoust, France and Rome, Italy to Montpelier, France, including the sale or exchange at fair market value of existing land and facilities at Fresno, California and Behoust, France; and the Agricultural Research Service may lease such existing land and facilities from the purchasers until completion of the replacement facilities and the foregoing limitations shall not apply to the purchase of land at Weslaco, Texas: Provided further, That not to exceed $190,000 of this appropriation may be transferred to and merged with the appropriation for the Office of the Assistant Secretary for Science and Education for the scientific review of international issues involving agricultural chemicals and food additives: Provided further, That funds may be received from any State, other political subdivision, organization, or individual for the purpose of establishing or operating any research facility or research project of the Agricultural Research Service, as authorized by law.

Special Fund: To provide for additional labor, subprofessional, and junior scientific help to be employed under contracts and cooperative agreements to strengthen the work at Federal research installations in the field, $2,500,000.

This change is proposed to allow ARS to purchase 4.3 acres of land adjacent to the Subtropical Agricultural Research Laboratory at Weslaco, Texas. This adjacent parcel was identified as the most suitable site for the future relocation of the laboratory and office spaces under the new facility master plan.

AGRICULTURAL RESEARCH SERVICE

Appropriation Act, 1993	$660,879,000
Budget Estimate, 1994	668,951,000
Increase in Appropriation	+8,072,000

Adjustments in 1993:		
Appropriation Act, 1993	$660,879,000	
Transfer to office of the Secretary [a/]	-212,000	
Adjusted base for 1993		$660,667,000
Budget Estimate, 1994		668,951,000
Increase over adjusted 1993		+8,284,000

a/ This transfer was made pursuant to the Secretary's authority provided by P.L. 102-341, dated August 14, 1992.

SUMMARY OF INCREASES AND DECREASES
(on the basis of adjusted appropriation)

Projects	1993 Estimated	Pay Cost	Other Changes	1994 Estimated
1. Research on soil, water, and air sciences	$82,424,000	+1,150,000	-50,000	$83,524,000
2. Research on plant sciences	241,443,000	+3,368,800	-144,800	244,667,000
3. Research on animal sciences	113,599,000	+1,585,000	-68,000	115,116,000
4. Research on commodity conversion and delivery	129,377,000	+1,805,200	-78,200	131,104,000
5. Human nutrition research	49,725,000	+358,900	+13,100	50,097,000
6. Integration of agricultural systems	25,808,000	+360,100	-16,100	26,152,000
7. Repair and maintenance of facilities	17,362,000	--	--	17,362,000
8. Contingencies	929,000	--	--	929,000
Total Available	660,667,000	+8,628,000	-344,000	668,951,000

Project Statement--Current Law
(on the basis of adjusted appropriation)

Project	1992 Actual AMOUNT	1992 Staff Years	1993 Estimated AMOUNT	1993 Staff Years	Increases or Decreases	1994 Estimated AMOUNT	1994 Staff Years
1. Research on soil, water, and air sciences....	$81,919,679	963	$82,424,000	942	+$1,100,000(1)	$83,524,000	938
2. Research on plant sciences....	245,545,381	3,438	241,443,000	3,366	+3,224,000(2)	244,667,000	3,350
3. Research on animal sciences....	112,529,670	1,629	113,599,000	1,592	+1,517,000(3)	115,116,000	1,585
4. Research on commodity converstion and delivery.	127,323,360	1,703	129,377,000	1,664	+1,727,000(4)	131,104,000	1,656
5. Human nutrition research......	49,884,529	228	49,725,000	225	+372,000(5)	50,097,000	224
6. Integration of agricultural systems.....	25,932,124	208	25,808,000	203	+344,000(6)	26,152,000	202
7. Repair and maintenance of facilities........	16,036,124	- -	17,362,000	- -	- -	17,362,000	- -
8. Contingencies	a/	- -	929,000	- -	- -	929,000	- -
Unobligated balance......	1,610,133	- -	- -	- -	- -	- -	- -
Total, available or estimate....	660,781,000	8,169	660,667,000	7,992	+8,284,000	668,951,000	7,945
Transfer to the Office of the Secretary......	98,000	- -	212,000	- -			
Total, Appropriation.......	660,879,000	8,169	660,879,000	7,992			
Investment Proposal.......						7,000,000	10
Total, President's Budget.........						675,951,000	7,955

a/ Obligations incurred under the Research Contingency Fund in 1992 amount to $928,523 and are reflected within each research project.

AGRICULTURAL RESEARCH SERVICE

Explanation of Program

Under the Agriculture, Rural Development and Related Agencies Appropriations, the Agricultural Research Service develops the means for:

1. Managing and enhancing the Nation's soil, water, and atmospheric resources to optimize agricultural productivity and environmental quality. -- Research is conducted to develop the technology for assessing and predicting long-term changes in the quantity and quality of the Nation's soil, water, and atmospheric resources; to provide the technology needed for improving, protecting, and restoring the productive capacity of agricultural soils; to develop improved soil and water management systems and practices to optimize the quality and efficient use of water resources; and to understand and optimize interactions of climate with soil, water, crops, and their management; and through better management, enhance the environment.

2. Maintaining and increasing the productivity and quality of crop plants. -- Research is conducted on collection and preservation of plant genetic resources; use and modification of these genetic resources to develop new improved high-quality, pest-resistant, stress-tolerant crop varieties to satisfy domestic and export needs; improved production practices and crop management systems which increase production efficiency and help protect the environment; methods of biological control and other pest management practices to reduce crop losses from insects, diseases, nematodes, and weeds; biology of economic plants and major pests to better understand the biochemistry and function of living organisms; mapping of important genes of major crop plants; and new and alternate high-value crops particularly for small farm operations.

3. Increasing the productivity of animals and the quality of animal products. -- Research is conducted to increase the genetic capacity of animals for production; to improve the efficiency of reproduction and reproduction-related biological processes; to improve animal nutrition and feed efficiency to increase productivity and product quality; to develop ways to prevent or control losses from diseases, parasites, and toxicants and other substances that limit animal performance and reduce the quality of animal products; to develop means for controlling insects, ticks, and mites that affect animals and man; and to devise means for improving and integrating procedures and facilities for production and transport of animals to increase productivity, reduce costs, and enhance animal well-being.

4. Achieving maximum use of agricultural commodities in domestic markets and export. -- Research is conducted to maintain and improve the economic viability and competitiveness of U.S. food, feed and industrial products and commodities in the current global market by developing the knowledge and means to improve quality and performance characteristics, to meet consumer safety criteria, and to eliminate trade barriers; by providing the knowledge and technologies needed by action and regulatory agencies to assure quality and safety; by devising economic, environmentally benign, safe processing concepts; and by expanding domestic and export market opportunities through the development of value-added food and nonfood products.

5. Promoting optimum human health and well-being through improved nutrition and family resource management. -- Research is conducted to define the cellular and molecular functions, requirements, and interactions of nutrients for humans at all stages of the life cycle; to explore genetic diversity and individual variation in nutrient needs; to develop methods for determining the nutrient content of agricultural commodities

and processed foods as eaten, and establish the bioavailability of their nutrients; and to improve the nutritional status of humans and the well-being of families by making techniques available for assessing the nutrient intake and nutritional status of the population.

6. Integrating knowledge of agricultural production, processing, and marketing into management systems which optimize utilization of users resources and net returns. -- Research is conducted to develop integrated systems for efficiently producing, processing, and marketing agricultural products; and to develop alternative production systems, adapted to users with widely varying resources, which are economically and environmentally sustainable.

7. Repair and maintenance of facilities. -- Funds are used to repair and maintain ARS facilities to provide safe, energy-efficient and functional workspace for in-house research. ARS is committed to adequately funding routine maintenance and repair to assure that all facilities are properly maintained. Each location also allocates program funds as appropriate, to perform the most pressing repairs or maintenance of facilities.

8. Contingencies. -- These funds established by Congress in fiscal year 1962, provide for necessary contingency financing for urgent items requiring immediate research action, including research demanded by emergency situations, unforeseeable research needed because of unexpected scientific breakthroughs, funding for damaged but urgently needed facilities, and other related needs where time is of the essence.

9. Construction of facilities. -- These funds complement the funding appropriated under the Buildings and Facilities account to accelerate the restoration and upgrading of research laboratories and buildings and facilities.

The research performed by Agricultural Research Service (ARS) is authorized by the Department of Agriculture Organic Act of 1862 (7 U.S.C. 2201, 2204); the Research and Marketing Act of 1946, as amended (7 U.S.C. 427, 1621); the Food and Agriculture Act of 1977, as amended (7 U.S.C. 1281 note); the Food Security Act of 1985 (7 U.S.C. 3101 note); and the Food, Agriculture, Conservation, and Trade Act of 1990 (7 U.S.C. 1421 note).

JUSTIFICATION OF INCREASES AND DECREASES

(1) A net increase of $1,100,000 for research on Soil, Water, and Air Sciences consisting of:

(a) An increase of $957,700 which reflects a 2.7 percent increase in non-salary costs.

(b) An increase of $1,150,000 which reflects the annualization of the fiscal year 1993 pay raise.

(c) A decrease of $860,000 for administrative efficiency.

Need for Change. To promote the efficient use of resources for administrative purposes in keeping with the President's Executive Order, total USDA baseline outlays for these activities will be reduced by 3 percent in FY 1994, 6 percent in FY 1995, 9 percent in FY 1996 and 14 percent in FY 1997.

Nature of Change. ARS will implement management efficiencies in all program and management areas to achieve savings in the conduct of research. These savings will be derived through salary areas of expenditures including travel, contracting, utilities and communications, printing and reproduction, consultants and other services, and purchases of supplies and materials. Savings to be achieved in travel, for example, will result from limiting the number of participants attending meetings and conferences and utilizing teleconferences in lieu of travel.

(d) A decrease of $133,300 which reflects a reduction in full-time equivalent employment.

This reduction is made pursuant to Executive Order 12839, dated February 10, 1993. In compliance with this directive, positions will be vacated through attrition only and not by reduction-in-force.

(e) A decrease of $14,400 for FTS 2000 funding.

This decrease reflects lower long distance telecommunications prices due to price redeterminations in the FTS 2000 contracts.

(2) A net increase of $3,224,000 for research on Plant Sciences consisting of:

(a) An increase of $2,805,400 which reflects a 2.7 percent increase in non-salary costs.:

(b) An increase of $3,368,800 which reflects the annualization of the fiscal year 1993 pay raise.

(c) A decrease of $2,517,500 for administrative efficiency.

Need for Change. To promote the efficient use of resources for administrative purposes in keeping with the President's Executive Order, total USDA baseline outlays for these activities will be reduced by 3 percent in FY 1994, 6 percent in FY 1995, 9 percent in FY 1996 and 14 percent in FY 1997.

Nature of Change. ARS will implement management efficiencies in all program and management areas to achieve savings in the conduct of research. These savings will be derived through non-salary areas of expenditures including travel, contracting, utilities and communications, printing and reproduction, consultants and other services, and purchases of supplies and materials. Savings to be achieved in travel, for example, will result from limiting the number of participants attending meetings and conferences and utilizing teleconferences in lieu of travel.

(d) A decrease of $390,500 which reflects a reduction in full-time equivalent employment.

This reduction is made pursuant to Executive Order 12839, dated February 10, 1993. In compliance with this directive, positions will be vacated through attrition only and not by reduction-in-force.

(e) A decrease of $42,200 for FTS 2000 funding.

This decrease reflects lower long distance telecommunications prices due to price redeterminations in the FTS 2000 contracts.

(f) An amount of $500,000 for Germplasm Evaluation Program at Tennessee State University (1890 Center of Excellence), to be funded from within the total proposed FY 1994 Budget:

Need for Change: ARS has conducted an active tree and shrub germplasm and variety development program at the U.S. National Arboretum, Washington, D.C. This program is intended to serve the entire country which requires regional evaluation of new improved germplasm for local adaptation and for adaptation to specific wholesale production areas of nursery crops. The eastern production area of wholesale nursery stock is centered in Tennessee, and more specifically around McMinnville. There is a need to evaluate the germplasm and new improved selections from the National Arboretum tree and shrub breeding program. The selection of plant material resistant to insect, disease, and nematode pests would greatly reduce the use of pesticides now being used by homeowners and municipalities to control insect and disease pests. Tennessee State University (TSU) has acquired land at McMinnville and has committed over $3 million dollars for a Nursery Crops Research and Extension Center. There is opportunity and need for ARS to become a partner in this planned research activity at TSU.

Nature of Change: Within the total proposed budget for FY 1994, ARS proposes to expand an existing cooperative research program with TSU on the evaluation of plant germplasm of interest to the U.S. nursery industry. Emphasis would be on selection of plant material that would be resistant to insect, disease, and nematode pests and tolerant to stress caused by cold, heat, drought, air pollution, and other environmental factors. These plant evaluations would be cooperative with the tree and shrub breeding program at the U.S. National Arboretum, Washington, D.C. The Research Committee of the Tennessee Nursery Association has expressed an interest in participating in these evaluations. ARS scientists would be located at the Nursery Crops Research and Extension Center at McMinnville. The Soil Conservation Service (SCS) has also expressed an interest in cooperating in the planned research. SCS has a large number of Plant Material Centers to propagate and distribute native and improved trees and shrubs to protect marginal lands against soil erosion. These

research activities will also provide educational opportunities for 1890 students and encourage the students to become greater involved in small farm and small business operations associated with the production and sale of nursery corps.

(3) A net increase of $1,517,000 for research on Animal Sciences consisting of:

(a) An increase of $1,320,000 which reflects a 2.7 percent increase in non-salary costs.

(b) An increase of $1,585,000 which reflects the annualization of the fiscal year 1993 pay raise.

(c) A decrease of $1,184,500 for administrative efficiency.

Need for Change. To promote the efficient use of resources for administrative purposes in keeping with the President's Executive Order, total USDA baseline outlays for these activities will be reduced by 3 percent in FY 1994, 6 percent in FY 1995, 9 percent in FY 1996 and 14 percent in FY 1997.

Nature of Change. ARS will implement management efficiencies in all program and management areas to achieve savings in the conduct of research. These savings will be derived through non-salary areas of expenditures including travel, contracting, utilities and communications, printing and reproduction, consultants and other services, and purchases of supplies and materials. Savings to be achieved in travel, for example, will result from limiting the number of participants attending meetings and conferences and utilizing teleconferences in lieu of travel.

(d) A decrease of $183,700 which reflects a reduction in full-time equivalent employment.

This reduction is made pursuant to Executive Order 12839, dated February 10, 1993. In compliance with this directive, positions will be vacated through attrition only and not by reduction-in-force.

(e) A decrease of $19,800 for FTS 2000 funding.

This decrease reflects lower long distance telecommunications prices due to price redeterminations in the FTS 2000 contracts.

(4) A net increase of $1,727,000 for research on Commodity Conversion and Delivery consisting of:

(a) An increase of $1,503,200 which reflects 2.7 percent increase in non-salary costs.

(b) An increase of $1,805,200 which reflects the annualization of the fiscal year 1993 pay raise.

(c) A decrease of $1,349,600 for administrative efficiency.

Need for Change. To promote the efficient use of resources for administrative purposes in keeping with the President's Executive Order, total USDA baseline outlays for these activities will be reduced by 3 percent in FY 1994, 6 percent in FY 1995, 9 percent in FY 1996 and 14 percent in FY 1997.

Nature of Change. ARS will implement management efficiencies in all program and management areas to achieve savings in the conduct of research. These savings will be derived through non-salary areas of expenditures including travel, contracting, utilities and communications, printing and reproduction, consultants and other services, and purchases of supplies and materials. Savings to be achieved in travel, for example, will result from limiting the number of participants attending meetings and conferences and utilizing teleconferences in lieu of travel.

(d) A decrease of $209,200 which reflects a reduction in full-time equivalent employment.

This reduction is made pursuant to Executive Order 12839, dated February 10, 1993. In compliance with this directive, positions will be vacated through attrition only and not by reduction-in force.

(e) A decrease of $22,600 for FTS 2000 funding.

This decrease reflects lower long distance telecommunications prices due to price redeterminations in the FTS 2000 contracts.

(5) A net increase of $372,000 for research on Human Nutrition, consisting of:

(a) An increase of $577,800 which reflects a 2.7 percent increase in non-salary costs.

(b) An increase of $358,900 which reflects the annualization of the fiscal year 1993 pay raise.

(c) A decrease of $518,600 for administrative efficiency.

Need for Change. To promote the efficient use of resources for administrative purposes in keeping with the President's Executive Order, total USDA baseline outlays for these activities will be reduced by 3 percent in FY 1994, 6 percent in FY 1995, 9 percent in FY 1996 and 14 percent in FY 1997.

Nature of Change. ARS will implement management efficiencies in all program and management areas to achieve savings in the conduct of research. These savings will be derived through non-salary areas of expenditures including travel, contracting, utilities and communications, printing and reproduction, consultants and other services, and purchases of supplies and materials. Savings to be achieved in travel, for example, will result from limiting the number of participants attending meetings and conferences and utilizing teleconferences in lieu of travel.

(d) A decrease of $41,600 which reflects a reduction in full-time equivalent employment.

This reduction is made pursuant to Executive Order 12839, dated February 10, 1993. In compliance with this directive, positions will be vacated through attrition only and not by reduction-in-force.

(e) A decrease of $4,500 for FTS 2000 funding.
This decrease reflects lower long distance telecommunications prices due to price redeterminations in the FTS 2000 contracts.

(6) A net increase of $344,000 for research on Integration of Agricultural Systems, consisting of:

(a) An increase of $299,900 which reflects a 2.7 percent increase in non-salary costs.

(b) An increase of $360,100 which reflects the annualization of the fiscal year 1993 pay raise.

(c) A decrease of $269,800 for administrative efficiency.

Need for Change. To promote the efficient use of resources for administrative purposes in keeping with the President's Executive Order, total USDA baseline outlays for these activities will be reduced by 3 percent in FY 1994, 6 percent in FY 1995, 9 percent in FY 1996 and 14 percent in FY 1997.

Nature of Change. ARS will implement management efficiencies in all program and management areas to achieve savings in the conduct of research. These savings will be derived through non-salary areas of expenditures including travel, contracting, utilities and communications, printing and reproduction, consultants and other services, and purchases of supplies and materials. Savings to be achieved in travel, for example, will result from limiting the number of participants attending meetings and conferences and utilizing teleconferences in lieu of travel.

(d) A decrease of $41,700 which reflects reduction in full-time equivalent employment.

This reduction is made pursuant to Executive Order 12839, dated February 10, 1993. In compliance with this directive, positions will be vacated through attrition only and not by reduction-in-force.

(e) A decrease of $4,500 for FTS 2000 funding.

This decrease reflects lower long distance telecommunications prices due to price redeterminations in the FTS 2000 contracts.

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Agricultural Research Service
Summary of Investment Proposals

SUMMARY OF INCREASES AND DECREASES - INVESTMENT PROPOSAL

Item of Change	1994 Base Request	1994 Investment Proposal	1994 Total Request
Research on soil, water, and air sciences	$83,524,000	--	$83,524,000
Research on plant sciences	244,667,000	--	244,667,000
Research on animal sciences ...	115,116,000	--	115,116,000
Research on commodity conversion and delivery	131,104,000	+6,000,000 1/	137,104,000
Human nutrition research	50,097,000	--	50,097,000
Integration of Agricultural Systems	26,152,000	+1,000,000 2/	27,152,000
Repair and maintenance of facilities	17,362,000	--	17,362,000
Contingencies	929,000	--	929,000
Total Available	668,951,000	+7,000,000	675,951,000

1/ Consists of: $4,300,000 for new conversion technologies
1,700,000 for research on biofuels

2/ For improved farm management systems.

Explanation of Investment Proposals

$4,300,000 for New Conversion Technologies.

Need for Change. Development of new and expanded uses of agriculture commodities is vital to the economic stability of U.S. farmers and rural communities, and to enhancing the competitive position of U.S. agriculture in world markets. New societal and environmental product demands offer market opportunities for natural and environmentally compatible products derived from renewable resources. In addition, new technological opportunities abound to achieve those market opportunities. Bioconversion, enzyme engineering, critical and super-critical processing, membrane separation and reaction, and extrusion all offer viable technological potential to meet the economic challenge of conversion of agricultural commodities to new useful products.

Expansion of the markets for agricultural commodities is essential to the maintenance of the economic competitiveness of the U.S. Market expansion can be enhanced through an increase in product quality. Real time technologies for quality assessment are essential for establishing, maintaining, and assuring product quality and market competitiveness. Though the U.S. has led the world in establishing highly effective grading systems, the rate of change in the production, marketing, and processing sectors of the agricultural system has created a demand for new, more objective means of assessing commodity properties and values. A worldwide increase in handling and processing automation has produced an upsurge in demand for uniformity, and market emphasis on quality has generated the need for new knowledge of the properties important to end use. Furthermore, the international focus on agricultural trade in GATT, CODEX, the U.S.-Canada trade agreement, and the potential agreement with Mexico have each contributed special needs with regard to grades and standards.

Nature of Change. The emphasis of the ARS component of the Advanced Manufacturing Initiative is on industrial uses of agricultural commodities.

Develop new products from animal derived materials, ($600,000): Devise cost-effective technologies for the separation and conversion, including the bioconversion of tallow into environmentally acceptable products such as detergents. Devise cost-effective fermentation strategies for the conversion of whey and whey constituents to industrial products for the health care industry.

Technologies for development of advanced materials and products from plant chemicals, agricultural products, starch, lipids, and proteins, ($2,700,000) Utilize and develop new and improved technologies for cost-effective production of value-added products and advanced materials that have functional and structural properties which can uniquely meet specific market demands. Emphasis will be on those properties of natural polymers that offer unique opportunities for economic modification and conversion to products that are competitive in cost and function with those derived from non-renewable sources.

New Technologies for Quality Assessment, ($1,000,000): Develop rapid automated methods to screen and quantify those quality parameters important to domestic and export competitiveness of U.S. commodities.

$1,700,000 for research on Biofuels

Need for Change. Increased utilization of biofuels made from agricultural crops offers the potential to address both economic and environmental challenges which are national priorities. In addition to reducing dependence on foreign oil, contributing to USDA goals on rural development, conversion of raw agricultural commodities to higher value products, enhancement of farm income, and reduction of farm program costs, these needs are compatible with the objectives of the National

Energy Policy Act, the Clean Air Act Amendments and State regulations, and the Department's Global Change Plan. There is a need to improve technology for producing ethanol and biodiesel fuels to more efficiently produce the agricultural feedstocks from which these biofuels are converted and to increase the value of the conversion residues.

Alcohol and biodiesel fill the needs for environmentally benign fuels and heightened energy security for the United States. Moreover, they form a significant component of an overall strategy to convert raw bulk commodities to marketable value-added co-products and to help stabilize the farm sector.

Nature of Change. The strategy of the ARS Biofuels component of the Advanced Manufacturing Initiative is to improve technology and processing systems that reduce the cost of producing the biofuels.

Develop Improved Conversion Technologies and Systems, ($1,700,000): Research on new pretreatment technologies for grain and energy crops to improve production efficiency and capturing high value coproducts will be initiated and efforts on development of enzymes and microorganisms for hydrolysis and fermentation, and separation processes will be expanded. Through screening and genetic engineering of more effective enzymes and microorganisms, the hydrolysis and fermentation processes will require less time and produce high yields of ethanol. Separation processes that are simultaneous with the fermentation will be developed to enhance higher ethanol yields at lower energy requirements.

Technology will be enhanced for producing biodiesel from vegetable oils and animal fats by improving the chemical and physical properties. Performance characteristics, including emissions, of the most promising biodiesel fuels will be determined.

$1,000,000 for Improved Farm Management Systems

Need for Change. Sustainability of agriculture as an integral part of the total ecological universe has recently become an overriding consideration in the planning of farming systems. Consequently, concerns for the quality of surface and ground waters and other ecological qualities of the land have joined, and to a degree supplanted, traditional concerns for soil erosion and its threat to sustained soil productivity. At the same time, increasing international economic competition and the need to reduce public expenditures demand new farming systems that enhance the competitiveness of American farmers and reduce the use of public funds.

The Soil Conservation Service (SCS) is committed to deploying a new multi-objective planning system, SWAPA (for Soil, Water, Air, Plants, and Animals) for evaluating farm management plans. Previous decision-support technology delivered by ARS to SCS has addressed specific problems such as water erosion, wind erosion, and groundwater quality. Experience has shown that a management plan designed to solve only one of these problems can exacerbate another. To support the SWAPA initiative, ARS must develop a new, broad-based and multi-objective soil conservation system evaluation methodology that can be applied at the farm, ranch and watershed scale.

Nature of Change. Develop integrated technology and decision support systems in support of the Advanced Manufacturing Initiative.

Intelligent Farm Management Systems ($750,000) Develop integrated technology (sensors, instrumentation, controls robotics, image analysis, computer software, and decision support systems) to improve resource management and crop and livestock production systems.

<u>Decision-support technology in support of the SCS multi-objective planning systems ($250,000)</u> The research will extend the power of newly developed or emerging erosion prediction technology, water quality, crop production, and farm planning models to address landscape and farm-scale problems in a systems context needed to fully implement SWAPA in new decision-support systems. The systems will also build on a rapidly developing body of multi-object decision theory to evaluate alternative management practices. The technology will be developed using system engineering principles in close cooperation with the SCS to identify user requirements. The anticipated technology will consist of computer based systems which incorporate user interfaces, and expert systems, data bases, simulation models, and decision models.

Investment Language

AGRICULTURAL RESEARCH SERVICE

In addition to funding already available under this head, and subject to the same terms and conditions, $7,000,000 for the Agricultural Research Service to provide for research and demonstration of advanced manufacturing technologies in the production and utilization of agricultural commodities.

United States Department of Agriculture
Agricultural Research Service

CONTINGENCY RESEARCH FUND--FY 1992

The Contingency Research Fund, established by Congress in Fiscal Year 1962, is designed to provide a ready source of funds to meet unforeseen and immediate research needs. Releases from the fund are generally made in situations where an emergency funding exists, such as an unexpected scientific "breakthrough," or outbreaks of diseases or pest problems where it appears inadvisable to wait for consideration of additional funding through the regular budget process. In allocating these funds, the agency policy is to make no commitment beyond the current fiscal year.

	1992 Releases
Irrigation system restoration, Mandan, North Dakota	$50,000
Repair/replace irrigation pumps and pipes, lawn mower, lab flooring, insulation, pickup truck caused by flood damage, College Station, Texas	12,900
Repair/replace telephone system, Kerrville, Texas	36,000
Replace centrifuge, spectrophotometer, calculators, chairs, etc. damaged by fire, Madison, Wisconsin	29,000
Repair roads, fences, irrigation lines, pruning tower and building caused by flood damage, Brownwood, Texas	69,400
Replace feed processors, autoclave, balances, incubators, freezers, glassware, dishes, etc. destroyed by fire, Tifton, Georgia	41,000
Asbestos cleanup, Gainesville, Florida	43,160
Provide for increased funds for taxol research--dedicated computer system, equipment; and fund cooperative project on taxol with Cornell University Ithaca, New York	100,000
Replace analyzer, spectrophotometer, pumps, water purification system, detectors, etc. destroyed by fire, Beltsville, Maryland	55,000
Repair panes in greenhouse damaged during hail storm, Orlando, Florida	11,305
Purchase supplies (roofing paper, plywood, chain saws, wheelbarrows, drinking water, heavy duty plastic) and repair/replace equipment (front-end loaders, vehicles, computers, phone system) damaged by Hurricane Andrew, Miami, Florida	45,758
Provide for increased sweet potato whitefly research:	
College Station, Texas	20,000
Weslaco, Texas	75,000
Phoenix, Arizona	70,000
Stoneville, Mississippi	15,000
Tifton, Georgia	45,000
Beltsville, Maryland	65,000
Orlando, Florida	145,000
Total, Contingency Research Fund	928,523

STATEMENT OF OBLIGATIONS AND STAFF-YEARS BY LOCATION
(On basis of adjusted appropriation)

Location	Actual 1992		Estimated 1993		Estimated 1994	
	Dollars	Staff-Years	Dollars	Staff-Years	Dollars	Staff-Years
ALABAMA, Auburn........	$2,687,681	39	$2,745,400	38	$2,781,800	38
ALASKA, Fairbanks......	716,073	9	725,700	9	735,300	9
ARIZONA						
Phoenix..............	6,519,955	98	6,273,200	95	6,802,500	96
Tucson...............	3,337,996	45	3,138,300	44	3,177,400	44
Total........	9,857,951	143	9,411,500	139	9,979,900	140
ARKANSAS						
Booneville...........	1,293,648	21	1,336,700	21	1,354,500	21
Fayetteville.........	882,676	6	951,100	6	963,800	6
Stuttgart............	552,163	4	551,900	4	559,200	4
Total........	2,728,487	31	2,839,700	31	2,877,500	31
CALIFORNIA						
Albany...............	21,036,164	242	20,073,800	236	21,051,600	237
Brawley..............	304,780	7	302,300	7	306,300	7
Davis................	1,690,933	27	1,594,400	26	1,615,600	26
Fresno...............	5,023,616	76	4,020,000	72	4,069,100	71
Pasadena.............	1,508,058	19	1,497,800	19	1,517,700	19
Riverside............	4,111,527	51	3,866,700	49	3,914,500	49
Salinas..............	2,115,264	34	1,959,500	33	1,982,700	33
San Francisco........	4,710,532	44	4,603,100	42	4,664,300	42
Shafter..............	892,283	10	1,049,700	11	1,063,700	11
Total........	41,393,157	510	38,967,300	495	40,185,500	495
COLORADO						
Akron................	1,413,890	20	1,226,500	20	1,242,800	19
Fort Collins.........	10,712,938	144	10,504,200	139	10,622,700	138
Total........	12,126,828	164	11,730,700	159	11,865,500	157
DELAWARE						
Georgetown...........	707,938	10	747,800	10	757,700	9
Newark...............	627,094	12	609,700	11	617,800	11
Total........	1,335,032	22	1,357,500	21	1,375,500	20
DISTRICT OF COLUMBIA						
Program..............	4,261,769	64	4,390,800	62	4,448,900	62
Headquarters						
Federal Administration.....	32,177,612	524	38,375,800	513	38,954,100	508
Centrally Financed Services....	8,167,821	- -	8,305,400	- -	8,197,400	- -
Subtotal......	40,345,433	524	46,681,200	513	47,151,500	508
Total........	44,607,202	588	51,072,000	575	51,600,400	570
FLORIDA						
Brooksville..........	763,738	12	726,500	11	736,100	10
Canal Point..........	953,067	24	937,200	24	949,700	22
Fort Lauderdale......	690,983	12	667,300	11	676,200	11
Gainesville..........	10,072,602	142	9,559,000	138	9,681,500	136
Miami................	1,812,090	36	1,724,400	35	1,747,300	34
Orlando..............	4,636,923	67	4,327,400	65	4,384,400	64
Winter Haven.........	1,285,267	20	1,257,900	20	1,274,600	19
Total........	20,214,670	313	19,199,700	304	19,449,800	296

STATEMENT OF OBLIGATIONS AND STAFF-YEARS BY LOCATION
(On basis of adjusted appropriation)

Location	Actual 1992		Estimated 1993		Estimated 1994	
	Dollars	Staff-Years	Dollars	Staff-Years	Dollars	Staff-Years
GEORGIA						
Athens	14,803,837	197	14,593,400	192	15,596,000	194
Byron	2,200,199	45	2,135,900	44	2,164,000	43
Dawson	2,272,754	36	2,099,400	35	2,126,700	35
Experiment	1,639,250	25	1,652,800	25	1,674,800	25
Savannah	2,841,090	47	2,782,100	47	2,818,100	47
Tifton	8,282,499	117	8,068,300	115	8,160,100	114
Watkinsville	2,088,139	22	2,020,900	22	2,047,800	22
Total	34,127,768	489	33,352,800	480	34,587,500	480
HAWAII, Honolulu	8,683,321	89	8,786,300	88	8,863,200	88
IDAHO						
Aberdeen	1,880,568	19	1,929,200	20	1,949,400	20
Boise	1,586,516	21	1,792,500	21	1,816,300	21
Dubois	2,310,538	19	2,078,500	17	2,106,100	17
Kimberly	2,597,971	43	2,545,400	41	2,579,200	40
Total	8,375,593	102	8,345,600	99	8,451,000	98
ILLINOIS						
Peoria	25,327,967	295	25,111,600	293	26,861,300	295
Urbana	3,770,144	45	3,618,000	44	3,663,700	44
Total	29,098,111	340	28,729,600	337	30,525,000	339
INDIANA, Lafayette	4,819,049	40	4,602,500	39	4,661,700	39
IOWA, Ames/Ankeny	25,927,579	324	25,286,200	316	25,604,100	315
KANSAS, Manhattan	4,968,494	70	4,730,900	69	5,241,000	70
KENTUCKY, Lexington	1,555,669	17	1,535,200	16	1,555,600	16
LOUISIANA						
Baton Rouge	2,114,781	31	1,970,100	30	1,993,500	29
Houma	1,440,555	34	1,364,000	34	1,382,100	34
New Orleans	17,726,707	214	17,083,700	208	17,927,400	209
Total	21,282,043	279	20,417,800	272	21,303,000	272
MAINE, Orono	854,686	11	857,900	11	869,300	11
MARYLAND						
Beltsville	92,554,687	1,332	85,897,800	1,323	86,985,900	1,321
Frederick	2,394,618	34	2,133,600	32	2,161,400	32
Hyattsville	478,807	7	640,600	8	647,800	8
Total	95,428,112	1,373	88,672,000	1,363	89,795,100	1,361
MASSACHUSETTS, Boston	13,567,899	8	13,839,700	8	14,023,600	8
MICHIGAN, East Lansing	4,200,116	57	3,850,200	55	3,901,300	54

STATEMENT OF OBLIGATIONS AND STAFF-YEARS BY LOCATION
(On basis of adjusted appropriation)

Location	Actual 1992		Estimated 1993		Estimated 1994	
	Dollars	Staff-Years	Dollars	Staff-Years	Dollars	Staff-Years
MINNESOTA						
East Grand Forks.....	850,779	11	956,500	11	969,200	11
Morris...............	2,650,379	46	2,412,500	44	2,440,800	44
St. Paul.............	4,604,309	56	4,194,900	54	4,240,300	53
Total........	8,105,467	113	7,563,900	109	7,650,300	108
MISSISSIPPI						
Mississippi State....	6,529,023	98	6,483,400	96	6,566,800	95
Oxford...............	5,150,564	69	5,109,000	68	5,164,100	68
Poplarville..........	807,097	13	798,700	13	809,100	13
Stoneville...........	14,479,901	188	13,921,600	185	14,087,800	184
Total........	26,966,585	368	26,312,700	362	26,627,800	360
MISSOURI, Columbia.....	5,325,678	65	4,781,500	61	4,837,100	61
MONTANA						
Bozeman..............	1,795,850	44	1,672,200	42	1,693,600	42
Miles City...........	2,001,551	19	1,855,300	17	1,879,900	17
Sidney...............	798,323	13	681,500	13	690,500	13
Total........	4,595,724	76	4,209,000	72	4,264,000	72
NEBRASKA						
Clay Center..........	12,102,803	123	12,023,200	120	12,183,000	119
Lincoln..............	4,418,910	46	4,212,400	45	4,260,600	44
Total........	16,521,713	169	16,235,600	165	16,443,600	163
NEVADA, Reno...........	520,163	9	483,300	9	489,700	9
NEW JERSEY Chatsworth...........	501,963	4	511,000	4	517,800	4
NEW MEXICO Las Cruces...........	1,522,007	23	1,431,400	23	1,450,500	22
NEW YORK						
Geneva...............	1,333,642	10	1,197,700	9	1,213,700	9
Ithaca...............	3,879,814	41	3,660,600	40	3,709,200	40
Plum Island..........	9,900,622	69	8,981,900	65	9,101,200	64
Total........	15,114,078	120	13,840,200	114	14,024,100	113
NORTH CAROLINA						
Oxford...............	1,793,975	32	1,742,300	32	1,765,500	32
Raleigh..............	5,699,191	69	5,467,400	67	5,540,000	66
Total........	7,493,166	101	7,209,700	99	7,305,500	98
NORTH DAKOTA						
Fargo................	9,137,416	132	9,063,200	128	9,183,600	128
Grand Forks..........	7,298,402	65	7,264,200	64	7,360,700	64
Mandan...............	3,008,436	50	2,768,800	49	2,805,500	48
Total........	19,444,254	247	19,096,200	241	19,349,800	240

STATEMENT OF OBLIGATIONS AND STAFF-YEARS BY LOCATION
(On basis of adjusted appropriation)

Location	Actual 1992		Estimated 1993		Estimated 1994	
	Dollars	Staff-Years	Dollars	Staff-Years	Dollars	Staff-Years
OHIO						
Columbus.............	788,828	10	760,600	10	765,100	10
Coshocton............	1,083,447	18	956,600	17	969,300	17
Delaware.............	325,941	4	328,000	4	332,200	4
Wooster..............	2,372,615	42	2,351,700	42	2,381,200	41
Total........	4,570,831	74	4,396,900	73	4,447,800	72
OKLAHOMA						
Durant...............	2,368,777	40	2,443,500	39	2,473,300	38
El Reno..............	1,669,687	27	1,651,200	26	1,673,100	26
Lane.................	1,734,338	31	1,709,500	30	1,732,200	30
Stillwater...........	2,303,954	37	2,361,800	37	2,393,200	37
Woodward.............	1,284,802	19	1,251,700	19	1,268,300	19
Total........	9,361,558	154	9,417,700	151	9,540,100	150
OREGON						
Burns................	530,549	3	490,500	3	497,100	3
Corvallis............	4,543,313	74	4,485,400	71	4,542,700	71
Pendleton............	1,453,568	19	1,425,300	18	1,444,200	18
Total........	6,527,430	96	6,401,200	92	6,484,000	92
PENNSYLVANIA						
University Park......	2,829,318	45	2,822,800	45	2,857,600	45
Wyndmoor.............	20,205,315	240	19,534,400	235	21,143,600	237
Total........	23,034,633	285	22,357,200	280	24,001,200	282
SOUTH CAROLINA						
Charleston...........	2,588,772	43	2,562,400	42	2,595,800	42
Clemson..............	1,855,539	32	1,856,500	32	1,881,100	32
Florence.............	2,223,440	32	1,971,300	30	1,995,500	30
Total........	6,667,751	107	6,390,200	104	6,472,400	104
SOUTH DAKOTA						
Brookings-Madison....	1,856,208	39	1,651,800	38	1,672,100	37
TENNESSEE						
Jackson..............	177,911	2	164,700	2	166,900	2
Lewisburg............	143,457	2	144,100	2	146,000	2
Total........	321,368	4	308,800	4	312,900	4
TEXAS						
Beaumont.............	1,059,628	17	950,500	17	962,100	16
Brownwood............	670,256	15	573,900	14	581,500	13
Bushland.............	2,267,345	39	2,213,500	39	2,242,900	38
College Station......	11,118,300	163	10,823,100	158	10,960,200	158
Houston..............	10,189,849	10	10,166,000	10	10,301,100	10
Kerrville............	2,650,118	45	2,657,100	44	2,692,400	44
Lubbock..............	3,297,549	55	3,142,600	53	3,184,400	53
Temple...............	3,207,497	51	3,090,600	49	3,131,700	49
Weslaco..............	7,721,653	114	7,288,300	111	7,605,500	111
Total........	42,182,195	509	40,905,600	495	41,661,800	492

STATEMENT OF OBLIGATIONS AND STAFF-YEARS BY LOCATION
(On basis of adjusted appropriation)

Location	Actual 1992		Estimated 1993		Estimated 1994	
	Dollars	Staff-Years	Dollars	Staff-Years	Dollars	Staff-Years
UTAH, Logan	4,040,983	56	3,939,100	55	3,991,400	54
VIRGINIA						
Suffolk	671,246	10	658,600	10	667,400	9
WASHINGTON						
Prosser	2,633,580	39	2,232,100	39	2,260,700	37
Pullman	7,233,833	101	6,504,100	98	6,590,500	97
Wenatchee	1,320,975	27	1,439,600	25	1,457,800	25
Yakima	2,855,502	54	2,694,600	51	2,725,000	51
Total	14,043,890	221	12,870,400	213	13,034,000	210
WEST VIRGINIA						
Beckley	3,421,771	53	3,489,100	52	3,534,400	52
Kearneysville	6,013,863	63	4,697,000	61	4,752,800	60
Total	9,435,634	116	8,186,100	113	8,287,200	112
WISCONSIN, Madison	5,544,571	69	5,141,300	68	5,209,600	67
WYOMING						
Cheyenne	1,554,268	19	1,592,800	19	1,613,900	19
Laramie	1,953,868	31	1,992,700	31	2,019,200	31
Total	3,508,136	50	3,585,500	50	3,633,100	50
PUERTO RICO						
Mayaguez	2,164,005	47	2,226,400	46	2,256,000	46
VIRGIN ISLANDS						
St. Croix	286,131	6	282,800	5	286,600	5
OTHER COUNTRIES						
Argentina, Buenos Aires	327,143	- -	279,400	- -	283,100	- -
France, Montpellier	3,048,528	5	1,844,900	4	1,869,400	4
Korea, Seoul	183,664	1	180,800	1	183,200	1
Mexico, Tuxtla Gutierrez	951,196	6	908,900	6	921,000	6
Netherlands, Rotterdam	366,122	1	336,100	1	340,600	1
Total	4,876,653	13	3,550,100	12	3,597,300	12

STATEMENT OF OBLIGATIONS AND STAFF-YEARS BY LOCATION
(On basis of adjusted appropriation)

Location	Actual 1992		Estimated 1993		Estimated 1994	
	Dollars	Staff-Years	Dollars	Staff-Years	Dollars	Staff-Years
Extramural and Funds Administered from Headquarters....	9,017,215	- -	27,014,600	- -	28,551,300	- -
Contingency Research Fund................	1/	- -	928,500	- -	928,500	- -
Repair & Maintenance of Facilities........	16,036,124	- -	17,362,500	- -	17,362,500	- -
Unobligated Balance....	1,610,433	- -	- -	- -	- -	- -
Subtotal, Available or Estimate..........	660,423,314	8,169	660,306,000	7,992	675,590,000	7,955
Allotment to Forest Service.......	357,686	- -	361,000	- -	361,000	- -
Transfer to Off. of Sec	98,000	- -	212,000	- -	- -	- -
TOTAL, Appropriation...	660,879,000	8,169	660,879,000	7,992	675,951,000	7,955

NOTE:

1/ Obligations incurred in 1992 under the Contingency Research Fund in the amount of $928,523 are reflected in the amount for recipient locations.

AGRICULTURAL RESEARCH SERVICE

STATUS OF PROGRAM

Current activities, progress, and programs under each project are outlined below:

RESEARCH ON SOIL, WATER AND AIR SCIENCES

Current Activities: Management guidelines, practices, and systems are being developed for promoting cost-effective conservation and enhancement of the quality and production capacity of our Nation's soil, water, and air resources for future generations. The research program stresses the development of resource management systems that farmers, extension specialists, and agri-industry can use to maintain and enhance farm profitability while minimizing or reversing adverse impacts on long-term productivity and the environment. The program includes research on technologies for assessing the effects of agricultural activities on the quality and productivity of the natural resource base and of changes in the quality of the resource base on the profitability and productivity of agriculture. Emphasis is given to the development of management practices that reduce soil erosion, improve chemical use efficiency, maintain an optimum physical and biological soil environment for plant growth, and conserve the quality and quantity of the Nation's surface water and ground water resources. Research is also conducted to ensure that soil and water conservation strategies are consistent with the productivity goals of agriculture and the long-term profitability of farming. Emphasis is being placed on water quality protection, sustainable agriculture, waste utilization, and a better understanding of the impact of global change on agricultural productivity and on soil and water conservation and protection.

Selected examples of recent progress:

Modified farming practices can improve water quality. The President's Water Quality Initiative defines a vigorous effort to protect ground and surface water from potential contamination by agricultural chemicals and wastes, especially pesticides and nutrients. Five Management Systems Evaluation Area (MSEA) projects at 10 discrete locations in the Midwest are developing cost-effective farming practices and systems that minimize water quality impacts. The Iowa MSEA project showed farming practices which reduced runoff also reduced herbicide movement. The Minnesota MSEA project found split application of nitrogen fertilizer to reduce nitrate-nitrogen leaching. The Missouri MSEA project learned that a high concentration of nitrate in the ground water was associated with pastured or cropped areas that received animal manures in the past. The Nebraska MSEA project used sprinkler irrigation to obtain high yields with the application of only a starter fertilizer. The Ohio MSEA project had dry conditions in 1991 which improved ground water quality. Validation of water quality models on data sets from all 10 locations, together with regional analyses of commonalities and specificities among the sites, will offer the opportunity to recommend environmentally friendly farming systems for various parts of the Midwest.

No-till management is found to decrease nitrate concentrations in ground water. Increased infiltration rates accompany high populations of surface feeding earthworms and reduction of surface sealing caused by leaving crop residues on the soil surface. Concern has been extensively expressed that the additional water entering the soil would increasingly contaminate the ground water. Studies in Iowa and Maryland showed that runoff is reduced and recharge to ground water is about doubled under no-till. The total amount of nitrate moved to the ground water is not greatly changed so the concentration of nitrates in the ground water is reduced to about half the concentration observed under conventionally tilled plots. Consequently, no-till management helps farmers increase both the quantity and quality of ground water.

No-till management not only conserves, but enhances soil organic matter. Since tillage of soils began it has exposed them to increased erosion and more rapid oxidation of their organic matter which degrades their productive capacity. Evaluations of long-term no-till management in Georgia, Alabama, Ohio, and Illinois show that organic matter increases under no-till management where the crop residues are left on the surface. The largest increase in organic matter is in the top two inches of the soil, but this is the most critical part of the soil volume because the organic, surface mulch tends to keep this zone moist and a major portion of the crop's feeder roots are contained therein. No-till management enables farmers to go beyond conservation and enhance the organic matter and productive capacity of their soils, storing more carbon in the process.

Crop residue management reduces soil erosion while increasing water conservation and crop yields. Soil erosion reduces soil productivity and results in siltation and pollution of surface waters. Scientists at Lincoln, Nebraska, have shown that not only can soil erosion be reduced to acceptable levels by using suitable crop residue management techniques, but also more rainfall is captured and saved in the soil. Since pesticides are often adsorbed on soil particles, reduced erosion also reduces the risk of pesticides in surface waters. This extra water, if properly used, can often increase crop yields 10 to 20%. By controlling weeds with herbicides rather than with tillage, greatest benefits are measured with least environmental damage. These practices are being used by the Soil Conservation Service in writing Conservation Plans for United States farmers to meet mandates of the 1985 and 1990 Farm Bills.

Grass hedges reduce erosion. Conventional bulldozer built terraces help control erosion but are expensive and remove water from fields rather than letting it soak in. Vetiver grass hedges with stiff closely spaced stems have retarded water flow, increased infiltration, and trapped sediment which formed terraces in other countries, but vetiver does not tolerate the cold temperature in the United States. Grasses which can form such hedges and tolerate United States climate have been identified and planted across hillsides and ephemeral gullies in Louisiana, Mississippi, Missouri, and Iowa where they are retarding water flow and trapping sediment. Flume studies in Mississippi show these grasses can remain erect in pond water over one foot deep. These hedges will provide farmers with a cost-effective means of reducing erosion and help them achieve conservation compliance mandated by the 1985 and 1990 Farm Bills.

Aquatic habitat is being restored in streams damaged by erosion. Stream channels in the bluff-line hills of northern Mississippi are steep, and their banks and beds unstable and easily eroded. As a result, many of the streams not only produce large amounts of sediment but also provide very poor fish habitat. Scientists at the National Sedimentation Laboratory, Oxford, Mississippi, have developed structural and vegetative measures that can stabilize these erosive channels, dramatically reduce their sediment loads, and improve aquatic habitat. The Agricultural Research Service is collaborating with the Soil Conservation Service and the United States Army Corps of Engineers in a major demonstration project to develop, and evaluate under field conditions, efficient and cost-effective measures for stabilizing rapidly eroding channels in the Yazoo River Basin. Some of these measures, such as the low-drop structure, have already been adopted by these collaborating agencies; others, such as bank stabilization using willow trees, are considered ready for routine adoption.

Straw mini-dams in crop furrows can save water. Studies indicate that annual sediment runoff from individual fields can be as high as 60 tons per acre when the furrow method of irrigation is used on row crops. One to three pounds of straw scattered along 100 feet of furrow slows the water flow and cuts runoff down the furrow by nearly half, according to a study in southern Idaho. That

helps protect erodible silty loam soils, which are fine and powdery when dry. The straw mini-dams also make irrigation water rise higher in the furrow. As a result, it soaks through the furrow sides and moves directly towards plant roots. In tests, extra water for the roots boosted yields of dry beans by as much as 62 percent. Yield results were similar for irrigated sugarbeets, corn, and potatoes. Scattering straw to form mini-dams in crop furrows can save water and soil--and increase yields of some crops.

Soil disruption associated with burying wastes in trenches increases water availability and cotton yields. Disposal of agricultural and municipal wastes are problems common to many portions of the United States. Proper burial and mixing of these wastes in the soil disrupted the cultivation pans, fragipans, and clay pans in Alabama and Missouri and allowed the crop roots to penetrate to and beyond the depths of burial. The wastes are helping maintain the open structure which allows penetration by the roots, which in turn help provide the fabric which can stabilize the soil structure. According to crop models and historical climatic data from these areas, increasing rooting depth by 50 percent can reduce incidence of drought induced crop failure to less than one third of current incidence.

Technology developed for monitoring cotton stalk destruction. Surveillance technology is needed by the Texas Department of Agriculture to enforce the September 1 deadline for the destruction of cotton stalks in South Texas. Prompt destruction of cotton stalks after harvest was mandated by the Texas legislature in 1987 because the practice greatly reduces the boll weevil population that overwinters in this area, thereby reducing damage to the next cotton crop. Scientists at Weslaco, Texas, have developed an aerial surveillance procedure that integrates video imaging techniques with global positioning systems, geographic information systems, and machine mapping capabilities to locate those cotton fields which still have undestroyed stalks after the deadline. Successful implementation of the program in the Rio Grande Valley will save farmers millions of dollars in pesticide spray costs and will significantly reduce the release of insecticides into the environment. The cost-effectiveness of this Agricultural Research Service development is being evaluated in cooperation with the Texas Department of Agriculture, prior to area-wide implementation.

Subsurface irrigation of cotton promotes use of shallow saline groundwater in drainage problem area in the San Joaquin Valley of California. The disposal of saline groundwater resulting from irrigation in the semi-arid San Joaquin Valley of California is the most significant problem facing agriculture in this highly productive area. A research and demonstration project using subsurface drip irrigation was developed on 60 acres of land located in an area with shallow groundwater at a depth of 3 to 5 feet. The irrigation system was installed at a depth of 18 inches below the soil surface and has operated to promote the use of moderately saline water. Results from the 1992 irrigation season indicate that nearly 50 percent of the crop water use was taken from the groundwater, meaning that the drainage water volume has been significantly reduced. The results can be used by farmers in the area, consultants, and extension specialists.

Innovative method developed for characterizing the properties of fractured geologic formations. Large areas of the North Atlantic Region are underlaid by bedrock at shallow depths. The properties of these geologic formations, in particular the depth and areal extent of the fractured bedrock, and its storage capacity and hydraulic transmissivity, have a dominant effect on the fate and transport of agricultural chemicals. Scientists at University Park, Pennsylvania, and at Beckley, West Virginia, have developed innovative techniques for estimating these critical hydraulic properties from water table observations and from well draw-down and seismic experiments. This work will provide reliable tools for delineating those areas that are most critical to effective management of groundwater quality. The techniques will also be

useful in determining the extent to which riparian zones might protect surface water quality. Potential beneficiaries include planning and regulatory agencies responsible for protecting the quality of rural water supplies.

Livestock grazing can be an environmentally sound strategy to limit shrub encroachment and distribute grass seed on range and pasture land. Over the past century, woody plants and noxious weeds have increased in abundance on sites formerly occupied by perennial grasses. Past research has emphasized chemical and mechanical treatments to reduce shrub populations, followed by seeding grasses with drills. Today, this treatment is often less acceptable and costly. Scientists from the Agricultural Research Service, Universities of Arizona and Mexico found that shrub seeds were killed by fire and passage through cattle and sheep. Scientists fed to cattle perennial grass seed inside gelatin capsules that dissolved as they passed through an animal's digestive tract. The seed, excreted in manure, germinated in a moist, fertile growing environment, thereby promoting the re-establishment of desirable range grasses.

RESEARCH IN PLANT SCIENCES

Current Activities: The research places emphasis on improving the efficiency of crop production and the quality of that production. By developing improved crop varieties, reducing costs and inputs associated with production, and improving quality (and value) to meet processor and consumer needs, this research will maintain and improve the competitiveness of our agricultural products in domestic and world markets. Research is conducted on a broad range of crops including grains, oilseeds, sugar crops, fruits, vegetables, ornamentals, forage, range, and industrial crops. The National Plant Germplasm System provides the foundation for genetic improvement and encompasses the acquisition, preservation, evaluation, and enhancement necessary to properly utilize plant germplasm. New technologies offer powerful tools that can be utilized in genetic mapping and gene transfer. A broad range of technologies are being utilized to protect plants from disease, insect, nematode, weed, and climatic stresses. These include quarantine, biocontrol, host-plant resistance, management systems, and chemicals. Special emphasis is placed upon integrated approaches that are effective, efficient, and protective of soil, air, and water resources.

Selected examples of recent progress:

Mini-iceberg lettuce: a new specialty vegetable. Iceberg lettuce is the mainstay salad vegetable for Americans. There is an increasing interest in other types of lettuce for variety, convenience, and kitchen efficiency. Soon to appear in the market are three new varieties of mini-iceberg lettuce developed by scientists at Salinas, California. Named Mini-Green, Ice Cube, and Blush, these latest entries in the specialty class are about the size of a softball. They have the advantage of one time use - one head equals one salad. Waste is eliminated as well as the prospect of deterioration because the remainder of a large head usually languishes for several days in the refrigerator. The tiny heads have the sweet taste, crispy texture, and firmness of their larger relative. Ice Cube and Blush will be most likely used for commercial production in the cool lettuce producing areas. Mini-Green has more heat resistance and may find a place in home gardens across the land. The mini lettuces will be appearing in the marketplace in early 1993.

Native predator of sweetpotato whitefly evaluated and distributed to commercial insectaries. The recent explosion of whitefly populations across the southern United States has left researchers and growers scrambling for new management tools. Basic biological studies conducted in central Florida by the Agricultural Research Service and University of Florida scientists demonstrated the tremendous appetite of a native predatory beetle, Delphastus

pusillus, for sweetpotato whitefly. The beetle has been distributed to other researchers for further evaluation in field and greenhouse crops, and to commercial producers of beneficial insects. Mass rearing and field testing is now underway in California and elsewhere. The beetle is being produced commercially and is being used by growers in some areas in their efforts to control whiteflies.

Boll weevil bait stick. A boll weevil attracticide device has been developed. The device is a 3-foot stick with a plastic cap on top. The cap contains a slow release formulation of the boll weevil's pheromone. The stick is coated with an attractive pigment, a feeding stimulant, and a small amount of toxicant. Boll weevils are highly attracted to these sticks and die shortly after touching the stick's surface. This control method combines new technology and chemistry. The device can be economically deployed for suppression of the boll weevil without disruption to the environment. During 1991 and 1992, the entire Rutherford County, Tennessee, cotton area was under a bait stick suppression program. As of July 1992, the population of boll weevils has been reduced by 99% over the 1989-91 levels in Rutherford County. Tests with the bait stick are being conducted at several other locations in the United States and in Central and South America.

Natural attractants for control of the pepper weevil. The pepper weevil is an important pest of peppers throughout the southern United States and is responsible for substantial yield reduction. Control of this pest using synthetic insecticides is hindered by problems associated with detecting the adults prior to pepper damage. Male pepper weevils produce natural chemicals (pheromones) that attract both male and female pepper weevils. During the past year, several of these male-specific compounds have been identified and prepared in the laboratory by entomologists at the National Center for Agricultural Utilization Research, Peoria, Illinois. Traps baited with a mixture of these compounds have been shown to capture weevils in the field and could be very useful in detecting and trapping pepper weevil adults. These compounds could become part of an effective pest management program for controlling the pepper weevil.

A new dispenser for the pheromone of the gypsy moth has now been incorporated into the Animal Plant and Health Inspection Service (APHIS) detection program. The dispenser currently used for monitoring gypsy moth populations with traps is expensive and cannot be deployed during early spring without risking loss of effectiveness. A new dispenser, designed by scientists in Beltsville, Maryland, and APHIS, has now been licensed to two firms and the 15,000-unit production of the dispensers by one of the companies was incorporated in the 1992 monitoring program. The new dispenser remains effective longer and is potentially less expensive than the previous design and can be deployed well in advance of moth flight, allowing for a cost savings to the monitoring program.

Formulation developed to protect viral insecticides against sunlight inactivation. The inactivation of microbial pesticides by sunlight-UV is one of the most serious limitations to their field use as biocontrol agents. Scientists at several Agricultural Research Service laboratories (Columbia, Missouri; Peoria, Illinois; and Beltsville, Maryland) have developed a simple, relatively inexpensive starch-encapsulation process to formulate a microbial insecticide (the nuclear polyhedrosis virus of Heliothis) with several sunlight-UV protectants. Preparations formulated with different UV-protectants were 5 to 10 times better than a formulation without a UV-protectant. Formulation of this type could provide producers and users more effective persistent microbial pesticides.

New wheat germplasm for resistance to greenbugs. The greenbug inflicts substantial damage to winter wheat in the Southern Great Plains every year. Researchers at Stillwater, Oklahoma, recently discovered that a gene

transferred from a rye plant into wheat provided excellent natural protection to the feeding damage caused by the greenbug. By using this new insect-resistant wheat germplasm, university and industry wheat breeders throughout the United States will be able to develop new and improved, genetically-resistant wheat cultivars for the farmer that will help reduce the damage caused by the greenbug.

Rust-resistant bean germplasm lines introduced. New bean germplasm lines are resistant to all 64 available races of the fungus that cause bean rust. Bean rust is one of the most destructive diseases of beans and can reduce yields by more than 80 percent. Collection, preservation, evaluation, and utilization of bean rust and resistant host germplasm has been coordinated by scientists at Beltsville, Maryland. Rust-resistant bean germplasm has been developed through breeding by crossing and backcrossing resistant host accessions with commercial cultivars in a cooperative program between Agricultural Research Service, university, and commercial breeders. Over the last several years, scientists have introduced 58 new, improved rust-resistant germplasm lines for use by producers.

Root-knot nematode resistant peanuts identified. The peanut root-knot nematode causes significant economic losses throughout the peanut production area of the southern United States. Chemicals for control of this pest are expensive and, because of environmental concerns, are becoming increasingly limited. There are no known sources of resistance in currently cultivated varieties. Research scientists at Tifton, Georgia, inoculated over 1,000 types of peanuts from the National Peanut Germplasm Collection with nematode eggs and measured the nematode reproduction and damage on each of the lines. Seven exotic peanut genotypes which have resistance to this nematode were identified. Resistance genes from these lines are being transferred to the commercial varieties grown by farmers.

Genome map of soybean being used to improve oil quality. Soybean oil accounts for approximately 75 percent of the edible vegetable oils consumed in the United States. The fatty composition of the oil is important in determining its nutritive quality as well as its suitability for various special uses. Scientists at Ames, Iowa, have developed a detailed molecular genetic map of the soybean and are using it to identify specific genes which modify the quality of the oil. This information is being used by plant breeders to develop new soybean varieties with reduced saturated fats and improved nutritional quality.

Profitable and successful conservation farming depends on weed management and crop rotation. Conservation tillage systems are recognized as a major method of controlling soil erosion which may exceed 140 tons/acre in the Palouse region of the Pacific Northwest. Until recently, lack of effective weed control and profitability have impeded the adoption of conservation tillage in the Pacific Northwest. Recent results from a large, field-scale, 6-year study conducted by scientists in Pullman, Washington, have shown for the first time that a 3-year crop rotation with effective weed control made reduced tillage more profitable and less risky economically than conventional tillage or continuous wheat growing in either tillage system. This reduced tillage system met conservation compliance provisions of the 1985 and 1990 Farm Bills. The Soil Conservation Service and Extension Service are using the weed control, production, economics, and residue management information from this study to develop regional farm plans for conservation compliance and profitable farming.

RESEARCH IN ANIMAL SCIENCES

Current Activities: The current research program places primary emphasis on improving the efficiency of livestock, poultry, and aquaculture production. Major

thrusts include improving the productivity of animals; assuring the quality and safety of animal products used as food for humans; and reducing losses due to diseases, parasites, and insect pests. To accomplish these goals, new technological innovations are needed to preserve and effectively utilize animal germplasm; understand how specific genes improve production, reproduction efficiency, and animal product quality; enhance genetic resistance to diseases, parasites, and insect pests; improve techniques to rapidly diagnose, prevent, manage, or eliminate diseases, parasites, and insect pests; and detect and control microbial and chemical residue contamination in live animals and animal products. The research is designed to solve both short- and long-term, high priority national problems and to address the needs of action and regulatory agencies. Research is under way on changing the genetic makeup of animals and influencing reproductive efficiency; improving nutritional and genetic redirection of undesirable lipids in animal products; improving conversion of feed to animal products; developing genetically engineered vaccines for protection against diseases, parasites, and insect pests; new, rapid, and accurate methods of disease diagnosis; improving the safety of animal food products; and the integrated management of insect pests and disease vectors.

Selected examples of recent progress:

World Food Prize. Dr. Edward F. Knipling and Dr. Raymond C. Bushland, both retired ARS entomologists, were honored as recipients of the 1992 World Food Prize for their work in developing the sterile-male-release technique of insect control. Their pioneering breakthrough in biological insect control was begun in the 1950's, a time when pest-control strategies depended almost entirely on chemical pesticides. The sterile-male-insect-release method has led to the elimination of the screwworm in the United States and Mexico. This eradication has saved the livestock industry, and ultimately the consumer, billions of dollars. It has also been used effectively against Mediterranean fruit flies, Gypsy moths, boll weevils, and tsetse flies. The World Food Prize was conceived by Norman Borlaug-winner of the Nobel Peace Prize in 1970 for his work in agriculture-to recognize those whose contributions have significantly improved world food supplies. The World Food Prize was first awarded in 1986.

Mapping the animal genome. The USDA-ARS Animal Germplasm/Genome Research Programs have been expanded in response to the 1990 Farm Bill. In the germplasm program, a national database for all food animal species is being developed, and a central repository has been established to preserve germplasm that possesses unique genetic diversity. The major emphasis in the genome program is to develop a 20 cM genome map for beef and dairy cattle, sheep, poultry, and swine. These maps will identify the genotypes of the animals and provide important information that, when combined with traditional breeding, will accelerate the annual rate of genetic progress in animals. Through mapping, we will be able to isolate and identify genes that control economic traits, such as less fat and resistance to diseases. All results are being integrated into a computer database that will allow retrieval and relating of separate details that will eventually create a complete genome picture. A prototype database has already been established.

Linear scores of somatic cells in dairy genetic evaluation. Somatic cells in milk are related to mastitis, the most costly disease of dairy cattle. Selection of Sires of daughters with lower somatic cell scores should increase resistance to mastitis. Genetic evaluations for linear scores of somatic cells in milk of dairy cows were computed with the animal model after developing factors to adjust for known environmental effects. The feasibility of genetic evaluation for somatic cells was demonstrated by research scientists at Beltsville, Maryland; and implementation in the national dairy sire evaluation will genetically reduce the incidents of mastitis and decrease levels of somatic cells in milk, allowing for production of higher quality and more wholesome milk.

Diagnostic test for a genetic defect used by dairy industry. Bovine Leukocyte Adhesion Deficiency (BLAD) is a lethal genetic disorder that may occur in some Holstein calves between 2 weeks and 8 months of age, characterized by impaired immunity and early death. Scientists at Ames, Iowa, demonstrated the molecular and genetic cause of the disease and developed a diagnostic test. BLAD had become an especially serious genetic condition within the Holstein breed because some of the prominent sires of the breed are heterozygous for the genetic disorder. The occurrence of BLAD was on the increase; but as a result of the rapid application of the test, the genetic condition will be removed from Holsteins throughout the world in a couple of years. The development of the deoxyribonucleic acid (DNA) test for identifying carriers of this defect has allowed virtually all bulls actively used for artificial insemination to have been tested for the defective allele. The test was submitted for patent and licensed to United States and Canadian companies.

All male catfish populations possible. Channel catfish, *Ictalurus punctatus*, production by farmers continues to increase despite narrow profit margins. Cost of production could be reduced through the use of genetically improved or altered stocks. The much larger size of channel catfish males over females suggests that monosex culture, compared to the current mixed sex culture practice, would be economically advantageous for farmers. Scientists at Stoneville, Mississippi, developed experimental procedures to produce broodstock that produce all-male populations. The use of monosex male populations could produce more economical, uniform in size, and faster growing fish desired by farmers, processors, and consumers.

A brucellosis vaccine for use during the final stages of the APHIS eradication campaign has been developed. The United States is entering the final stages in a prolonged effort to eradicate brucellosis. Continued use of the existing live vaccine complicates this campaign because it produces antibodies in cattle identical to those produced by natural infection. Diagnostic tests cannot distinguish between vaccinated cattle and infected cattle for elimination. Scientists at Ames, Iowa, have developed a vaccine in which one or more of the antigens produced by the *Brucella* organism has been deleted. This "deletion" marker will permit identification of vaccinated cattle and can be used during the final stages of the eradication campaign or during emergency responses in the event of a re-introduction of brucellosis after eradication. This vaccine would facilitate exportation of vaccine-protected cattle from a brucellosis-free country, such as the United States, to other nations where brucellosis is still present.

A genetically engineered vaccine has been developed for Marek's disease in poultry. Marek's disease is one of the most important and highly contagious viral diseases of chickens that produces tumors and decreases growth rate and egg production. Except for flocks maintained under strict pathogen-free conditions, the virus is widespread and has been identified worldwide. Scientists at East Lansing, Michigan, have developed a genetically engineered vaccine to express genes from Marek's disease virus by using a recombinant fowlpox virus vaccine vector. The vaccine, which stimulates the chicken to produce antibodies to a Marek's disease virus protein, has proved effective in protecting chickens against infection with highly virulent Marek's disease virus strains. Under a technology transfer agreement, efforts are proceeding to commercially license this first genetically engineered Marek's disease virus vaccine.

Detection of Salmonella enteritidis strains that can be transmitted in undamaged eggs from laying hens. Human salmonellosis is a severe gastrointestinal disease caused by a bacteria, *Salmonella enteritidis*, and is associated with the consumption of undercooked eggs and egg products. Scientists at Athens, Georgia, have determined that certain strains of this bacteria can contaminate the egg contents of chickens before the shell has

formed. These strains were shown to produce a surface carbohydrate molecule that affects pathogenicity of the bacteria and facilitates transmission of the bacteria from infected chickens to their eggs. A procedure has been developed to detect the bacterial contaminant by using pools of egg contents from infected chicken flocks rather than by testing individual chickens. These studies may help to prevent this disease in humans and to determine the geographic distribution and spread of this bacteria in laying flocks.

New tests have been developed to detect bluetongue and epizootic hemorrhagic disease viruses in cattle, sheep, and wild ruminants. Bluetongue and epizootic hemorrhagic disease viruses are insect-transmitted viruses that cause a vesicular-like or hemorrhagic disease of domestic and wild ruminants. Presence of these viruses in the United States has caused the enactment of non-tariff trade barriers against livestock, livestock products, and cattle semen and fertilized embryos, and interferes with the unrestricted international movement of livestock and livestock products. Scientists at Laramie, Wyoming, have developed new tests to rapidly identify and serotype isolates of bluetongue and epizootic hemorrhagic disease viruses in blood of infected livestock and in infected insects, or to detect antibodies in the blood of previously infected livestock. These tests are currently being tested for use in the field and for use to certify semen to be free of bluetongue viruses.

The genome of African swine fever virus has been determined. African swine fever is a highly contagious viral disease exotic to the United States; but due to recent outbreaks caused by its introduction into the Western Hemisphere, it is a serious threat to the swine industry. The virus causes a high mortality in infected swine, and recovered animals may remain virus carriers for life. Currently, control of the disease is possible only by strict quarantine and slaughter. Scientists at Greenport, New York, working with cooperators at other laboratories have successfully sequenced the genome of this virus. By identifying the genetic makeup, scientists are able to identify individual genes and the protein products for which these genes encode. With this information, scientists can begin to work on development of vaccines and improved diagnostic procedures to identify infected or carrier swine. This will offer new strategies for control of this dreaded disease.

Computer model developed to predict litter size in swine. Litter size is physiologically complex, and the interactions among component traits that determine litter size are not well understood. Scientists at Clay Center, Nebraska, have developed a computer model to accurately predict litter size in swine. Computer modeling was used as a research method to integrate knowledge about component traits and to discover effective approaches to increase litter size. Simulated results of the computer model are similar to experimental observations. Changes in a single component will increase litter size only marginally; therefore, ovulation rate and uterine capacity both must be increased to dramatically improve litter size. Selection for a combination of component traits created more change in litter size than traditional selection directly for litter size. Use of this predictive model will improve our ability to select for litter size and lead to improved profits for swine producers.

A unique method for control of coccidiosis in chickens. The disease coccidiosis results in losses of approximately $300 million per year to the United States poultry industry. Scientists at Beltsville, Maryland, produced colostrum with antibodies specific for this parasite in cows, fed it to infected chickens, and found it reduced the number of developing stages and the severity of lesions compared with chickens that received normal colostrum or no colostrum. These findings suggest that this method of treatment offers an alternative to the use of chemicals for control of coccidiosis in chickens.

Treated sucrose lure selectively eliminates honey bee swarms in bait hives. Regulatory and research programs use bait hives extensively to detect and monitor Africanized honey bees. Bait hives also may become a major component of Africanized honey bee abatement programs. However, servicing of large numbers of bait hives is laborious and may pose a stinging hazard to abatement personnel. Scientists at Baton Rouge, Louisiana, have shown that packets of sugar containing acephate uniformly destroyed swarms of European honey bees in less than 2 days. The results suggest the addition of toxic sucrose lures to bait hives employed in Africanized honey bee survey or abatement programs may reduce costs and stinging incidents of abatement workers.

New forage grass varieties released with increased nutritive value. Two new forage grass varieties, "Manska" pubescent intermediate wheatgrass and "Tifton 85" bermudagrass, were released to farmers and ranchers. Scientists at Tifton, Georgia, found that Manska and Tifton 85 have significantly higher digestibility than the commonly grown varieties. In grazing trials, yearling steers gained .3 lb./day more on Manska intermediate wheatgrass than steers on the standard variety "Oahe." Manska dry matter yields were similar to Oahe. Manska is recommended for grazing and hay in regions of the northern and central Great Plains where annual precipitation exceeds 14 inches. Tifton 85 bermudagrass produced 30 percent more liveweight gain in grazing trials than the earlier variety "Tifton 78." In harvested plots, Tifton 85 produced 26 percent more dry matter that was 11 percent more digestible than the standard variety "Coastal." Tifton 85 is recommended for use in the Southeastern States.

RESEARCH ON COMMODITY CONVERSION AND DELIVERY

Current Activities: Development of new and expanded uses of agriculture commodities is vital to the economic stability of U.S. farmers and rural communities, and to enhancing the competitive position of U.S. agriculture in world markets. New technological opportunities abound to achieve those market opportunities. Bioconversion, enzyme engineering, critical and super-critical processing, membrane separation and reaction, and extrusion all offer viable technological potential to meet the economic challenge of conversion of agricultural commodities to new useful products. Increasing the competitiveness of United States commodities and products, while minimizing environmental impact and addressing safety needs of consumers, is paramount in determining postharvest research strategies. To meet this challenge, Agricultural Research Service research expands knowledge of physical, biological, and chemical characteristics of food, feed, fiber, and industrial products. This research is important to the acceptance of new products, the elimination of trade barriers, and is critical to commodity and product safety, quality, and value. Developing the technological basis for innovative industrial products that are benign to the environment and have sound commercial potential is being emphasized. Research is also being conducted to meet consumer demand for freshness and safety, and to address regulatory agency needs for methods to detect product contamination.

Selected examples of recent progress:

New oleochemical produced from seed oils. In order to open markets for new industrial oil seed crops and expand markets for oil seed crops already in production, new applications must be developed. Scientists at Peoria, Illinois, have converted fatty acids, the building blocks of vegetable oils, to higher molecular weight materials, called estolides. These compounds have potential utility in the lubricant and cosmetic industries. The procedures used to make these materials are those that are readily available to the oleochemical industry. This new technology can utilize unsaturated fatty acids from new crops such as meadowfoam and crambe, as well as from established crops such as soybean and sunflower. The differences in the composition of these seed oils provide a range of materials for different applications.

Improved method of producing a predominantly cotton yarn of superior properties. Although the textiles made of 100% cotton provide superior wear-comfort, compared to those made of synthetic fibers, they tend to shrink, wrinkle, and wear out. To minimize these problems, the cotton fibers are usually intimately blended with synthetic fibers, such as polyester, which are stronger than cotton and contribute to wrinkle resistance. However, the fabrics made of conventional blends still have certain deficiencies. For example, they still tend to shrink and lose some "cottony" feel because of synthetic fibers at the fabric surface, and the polyester causes the fabric to "pill," i.e. form unsightly fuzz-balls. Research at the Southern Regional Research Center, New Orleans, Louisiana, has led to the development of a unique core yarn which is composed of a central core of a strong 100% synthetic fiber and a sheath of 100% cotton fibers. The core provides superior strength, shrink-resistance and some wrinkle resistance, while the sheath provides the traditional properties of cotton. The invention has been patented and licensed in the United States and is expected to be utilized initially in the production of specialty (flame-retardant) fabrics.

Development of enriched barley glucan food ingredient. The utilization of oat and barley glucan in foods is limited by the low concentration (7%) of glucans naturally occurring in these cereal grains. Scientists at the Western Regional Research Center in Albany, California, have successfully developed a process that increases barley glucan and dietary fiber to 25 and 50% respectively. This ingredient has been evaluated favorably in pasta and bread at levels that meet Food and Drug Administration's requirement for fiber claims. This ingredient could be substituted for some or all of the flour in other cereal based products. A modified version of this process is already being adopted by one manufacturer. High glucan and dietary fiber content have been related to reduced blood cholesterol and glycemic response.

Environmentally friendly process for degumming soybean oil. Crude soybean oil contains a number of impurities that are normally removed by a series of processing steps which contribute to oil losses and environmental pollution. Researchers in Peoria, Illinois, developed a method to remove the impurities from crude soybean oil with carbon dioxide heated under pressure and thus eliminating waste byproducts. This technology yields high quality finished products, more edible oil and less environmental pollution since no waste soapstock is generated and use of bleaching clays is eliminated.

Evaluating sampling plans to improve detection of aflatoxin contaminated commodities. Because aflatoxin is not uniformly distributed in peanuts, most of the error in analysis for this unwelcome compound comes from use of samples that do not accurately represent the true amount of aflatoxin in the commodity. Dealing with this problem is critical to continued lowering of aflatoxin contamination in domestic and export edible peanuts. Scientists at Raleigh, North Carolina, and Dawson, Georgia, have measured the errors associated with various sample sizes and determined that certain statistical distributions accurately predict the distribution of sample test results. This information will serve as the foundation for evaluation and development of improved sampling plans. Accurate determination of aflatoxin levels provide greater food safety potentials in a wide variety of domestic and export commodities that may have nonuniform distributions of similar type compounds.

Preparation of a simulated human milk protein from cows' milk. The quality of infant formulas based on cows' milk can be improved significantly by altering its protein composition. Two proteins present in cows' milk but absent in human milk are believed responsible for poor digestibility and milk protein allergy in infants, respectively. Scientists at Wyndmoor, Pennsylvania, were able to reduce or eliminate these proteins by a combination of infiltration and precipitation. The process, for which a patent has been granted, yields a

product which can serve as an excellent protein base in the development of improved infant formulas.

Beefy-meaty flavor enhancer isolated from beef. Precoded, convenience foods represent a major segment of the meat industry. Beef, in particular, demonstrates flavor deterioration with a loss of desirable flavors and the rise of off-flavors following cooking and storage. Previous research devised and patented a process to inhibit off-flavor development. Research to prevent desirable flavor loss has led to the discovery and isolation of a peptide made of eight amino acids. This naturally occurring chemical isolated from beef has potent beefy-meaty flavor enhancing properties. This discovery may lead to ways of enhancing beef flavor by a variety of ways from improved cattle breeds to isolated seasonings which may be added to food replacing salt and monosodium glutamate (MSG).

Brushing machine cleans poultry carcasses. Chickens arrive at processing plants with dust, dirt and fecal material adhering to feathers, skin and feet. These contaminants are spread through the processing plant and contribute to the presence of bacteria on the finished product. In an effort to reduce the presence of these contaminants, scientists at the Richard Russell Research Center, Athens, Georgia, designed and built a carcass cleaning machine to "scrub" the carcasses prior to immersion in hot water to loosen the feathers. The machine has been tested under commercial conditions on over a million carcasses. The brushing motion of the rollers reduced the amount of contaminants in the scald water by 28%. This means that the scald water is cleaner and that the carcasses in the scald water are subjected to fewer contaminants.

New fungal chemicals that control insects. One of the most critical problems facing the agricultural chemicals industry is the discovery and registration of new environmentally safe pesticides (insecticides). Fungal survival structures, called sclerotia, have been shown to produce chemicals that protect the sclerotia from fungus-feeding insects. Scientists at Peoria, Illinois, in collaboration with scientists from the University of Iowa, have characterized 45 new antiinsectan chemicals from fungal sclerotia. These new antiinsectan sclerotial chemicals are of particular interest to the fields of agriculture and medicine for their biological activities and potential commercial application(s) and are presently being tested by a number of companies. The fermentation industry has not encountered these sclerotial metabolites because sclerotia form only on solid substrates and industry assays are performed on extracts of shaken liquid cultures.

Fabrication of a prototype grain sniffer. The United States Grain Marketing Laboratory in Manhattan, Kansas, has collaborated on developing several prototypes of grain odor "sniffers" for the Federal Grain Inspection Service (FGIS). One of the problems with the present "nose-in-grain" method of checking for grain odors is the health hazard of inhaling pesticides and toxic or allergenic dusts, including mold spores. A device which would allow inspectors to smell the grain without inhaling such dust would represent a safety and health improvement. However, the use of any kind of a filter seems to cut the intensity of most odors. Samples which are clearly off-odor by the standard test appear clean through a filter. Two devices to aid grain inspectors have been developed. A hand held prototype sniffer has been developed and delivered to FGIS for testing. The second prototype utilizes a compressed air supply rather than hand pump operation. The flow rate of air passing through the sample and exhausting for inspector assessment can be monitored and controlled over a range of values. Users have indicated that both the hand operated and the compressed air prototypes are acceptable.

Development of stable carbonated cappuccino milk and other novel milk beverages. Declining milk consumption in the United States has nutritional and economic implications. The Southern Regional Research Center in New

Orleans, Louisiana, has recently established a Cooperative Research and Development Agreement with a food company for final development and marketing of novel carbonated milk and fruit juice-milk beverages for domestic and export markets. Two products, carbonated cappuccino milk and orange juice-milk beverages, produced by a continuous process using ultra high temperature and short time (UHST) were successfully tested for shelf life and other qualities by the food company. These beverages will soon be test marketed. The successful development and marketing will provide nutritious foods for our discriminating population, and create domestic and foreign markets for our surplus agricultural commodities by converting them into value added foods, and improve our economy and trade balance.

RESEARCH ON HUMAN NUTRITION

Current Activities. Agricultural Research Service studies the effects of diet on healthy human volunteers of all ages. The objective of this research is to define nutrient requirements for pregnancy, growth and health of children, and nutrient function in the protection from disease of adults and the elderly. Particular emphasis is placed on the needs of infants at risk, protective factors in foods, dietary fat and carbohydrate needs to reduce risk of disease, and vitamin and mineral needs of individuals. The Agricultural Research Service chairs the USDA subcommittee for Human Nutrition, Research and Education Committee of the Secretary's Policy and Coordination Council. This subcommittee, composed of representatives from 10 agencies, has an active liaison with the Nutrition Coordinating Committee of the National Institutes of Health.

Selected examples of recent progress:

A nationwide study of selenium in beef products. Selenium is known to be an essential dietary nutrient, and beef is a major selenium source for the United States population. Therefore, it is important to know the variability of selenium in beef produced and sold throughout the Nation. Scientists at the Nutrient Composition Laboratory in Beltsville, Maryland, have measured the selenium content of more than 200 samples of retail beef cuts gathered from diverse markets. Included were uncooked beef cuts, ground beef, and fast-food hamburger sandwiches. Analyses were made by the modified selenium hydride generation procedure, and the accuracy of analyses was monitored by the use of National Institutes of Standards and Technology Standard Reference Materials. Researchers found the mean selenium concentration in various beef cuts were 13 to 20 micrograms per 3 oz. serving; that provides about one third of the daily recommended intake for an adult.

Effects of n-6 polyunsaturated fatty acids on immune status. Health organizations have recommended a reduction in the concentration of total calories from fat and an increase in the percent of calories from n-6 polyunsaturated fatty acids (PUFA) to improve cardiovascular health. However, diets rich in n-6 PUFA have been reported to suppress immune status in animal models, and the effects of such dietary changes upon human immune status are not well known. Scientists at the Western Human Nutrition Research Center in San Francisco, California, examined the effect of lowering dietary fat content while adding two levels of PUFA (3.1 or 9.1 energy percent) upon the immune status of seven healthy women. Lowering the fat content of the diet from 41 to 26 or 31 energy percent for 40 days enhanced several indices of the immune status, although there was no difference in the values of those based upon the PUFA content of the diets. Results indicate that a reduction in the intake of total fat, with a moderate increase in the percent of n-6 PUFA, may be beneficial not only for cardiovascular health, but also for improving immuno-competence.

Dietary energy needs of adults. Accurate recommendations on dietary energy (calorie) requirements form the basis for determining the amount of food aid

given to poor families, and also for assessing whether the food supply of different communities is adequate. Current Recommended Dietary Allowances (RDA) on energy needs are based on theoretical calculations because it was not previously possible to measure actual energy needs directly in individuals leading normal lives. Scientists at the Human Nutrition Center on Aging at Tufts University in Boston, Massachusetts, have successfully used the doubly-labeled water technique to make direct measurement of the energy requirements of young and old men. Findings indicate that energy recommendations have substantially underestimated usual energy needs and suggest that current RDA's may significantly underestimate usual energy requirements for physical activity. These new data contribute to a growing realization of the need to reevaluate energy intake recommendations and analysis of food consumption data.

Importance of trace elements and energy intake in sports. Scientific evidence has been generated to prove a functional relationship between performance and trace element status in people who are not severely nutritionally impaired. Whereas nutritional status has been considered to be an important predictor of physiologic function and performance, scientific evidence of the link has only existed for severe energy and iron restriction. The roles of other important micronutrients required for energy utilization--particularly copper, magnesium, and zinc--had not been tested until scientists at the Human Nutrition Research Center in Grand Forks, North Dakota, undertook tests with collegiate swimmers. These subjects showed that the best individual predictors of swim time were energy and trace element intakes. Decreases in swim times were associated with small, but apparently important, decreases in body copper stores and iron transport. Such information may be useful for nutritionists counselling individuals with vigorous lifestyles.

Effect of dietary fiber on human glucose and insulin response. As persons age, their ability to metabolize carbohydrates changes and elevated blood glucose or insulin levels are often identified. The simplest treatment would be to use dietary modifications to lower the glucose response. Corn starch in which 70 percent of the starch is in the form of amylose (a straight-chain structure,) rather than as amylopectin (the more common branched chain structure) has already been reported to lower insulin response. Scientists in the Carbohydrate Nutrition Laboratory in Beltsville, Maryland, have administered starch in several forms (corn starch with 70 percent of the starch in the form of amylopectin, or amylose made with or without corn meal). They found that insulin response--but not glucose response--was significantly decreased when amylose was consumed, compared to the response after amylopectin. Corn fiber did not significantly change any response curves and no interaction was found between fiber, starch, or insulin response to glucose. Thus, the amount of fiber does not appreciably affect human glycemic response, but amylose starch may prove beneficial in long-term dietary use.

Low-carotenoid diets quickly reduce plasma carotenoid levels. The human body uses carotenoids (colored substances found in fruits and vegetables) as part of its defense system to protect cells and tissues from the damaging byproducts of oxygen utilization. Until recently, the effect of a low-carotenoid diet on depletion of specific carotenoid levels in the blood had not been known. Scientists at the Western Human Nutrition Research Center in San Francisco, California, have completed a 3-month study during which healthy men were fed a diet containing no fruits or vegetables. In addition to monitoring the effects of such a diet on vitamin C levels, researchers also analyzed for five specific carotenoids in blood plasma taken at four points throughout the study. Blood levels of all five declined rapidly from the start and decreased to half of their initial values after 2-8 weeks. Determination of levels of these compounds may be useful in the assessment of short-term dietary intake. A lack of fruits and vegetables in the diet will

quickly lower blood levels of both important carotenoids and vitamin C, thus lowering antioxidant protection.

Table developed to show the caroteinoid content of fruits and vegetables. Carotenoids are substances found in foods--especially, fruits and vegetables--which may reduce the risk of certain cancers. To learn more about the role of carotenoids in the prevention of disease, researchers need to know the amount of carotenoids found in commonly eaten foods. Thus, scientists in the Nutrient Composition Laboratory in Beltsville, Maryland, have developed a table, using an artificial intelligence system to evaluate the quality of existing data for food carotenoid levels. The data was evaluated by examining the number of samples analyzed, scheme used for sampling, handling and storage of samples, method used for analysis, and use of quality control procedures. Those values judged to be acceptable were combined to create a table which contains the minimum, maximum, and median levels of beta-carotene, alpha-carotene, lutein, lycopene, and beta-cryptoxanthin in more than 120 foods. This data base of food carotenoid contents should be highly useful in the estimation of dietary amounts of specific carotenoids.

Dietary calcium and manganese affect menstrual cycle symptomatology. The menstrual cycle has been associated with changes in female physiology and behavior. Researchers at the Human Nutrition Research Center in Grand Forks, North Dakota, have attempted to determine if calcium and manganese in the diet might influence the symptoms associated with menstrual distress. Using 10 healthy young women with normal menstrual cycles and not taking oral contraceptives, they found that adding calcium to the diet resulted in reports of improved mood states, fewer undesirable behaviors, and better mental concentration during all three phases of the menstrual cycle. More calcium also resulted in reports of decreased water retention during the premenstrual phase and lessened pain during the menstrual phase. Adding manganese to the diet only improved status when additional calcium was also fed. These findings suggest that moderate increases in dietary calcium and manganese may be helpful in the management of symptoms associated with menstrual distress.

Measuring growth and energy expenditure in premature infants. Infants who are born prematurely must be frequently monitored to determine whether they are growing at an appropriate rate. Total body fat (TFM, or total fat mass) is known to be an indicator of the rate of growth and development of infants. Researchers at the Children's Nutrition Research Center in Houston, Texas, have now devised and validated an inexpensive method for measuring TFM in preterm babies. Their tests showed that an accurate estimation of total body fat can be made by measuring the subscapular skinfold thickness just beneath the infants' shoulder blades. Skinfold thickness measurements from biceps, thigh, and triceps were also shown to predict TFM, but in decreasing order of correlation relative to the subscapular measurement.

Preterm infants need mineral supplements. If an infant is born prematurely, the growth of its bones may be impaired. Researchers at the Children's Human Nutrition Center in Houston, Texas, studied two groups of 2-year-olds who had been born prematurely. These infants had been hospitalized at birth and while in the hospital they were fed their mothers' milk supplemented with calcium and phosphorus. After the infants had left the hospital, one group was fed infant formula; the other group continued to consume human milk, now by breast feeding. The scientists had hoped that the calcium and phosphorus supplements during the infants' stay in the hospital would assist bone growth whether their mothers later chose to breast feed or to feed formula. At 1 year of age, however, the breast-fed infants had lower rates of calcium and phosphorus accumulation in bone than the formula-fed group. The same two groups at 2 years had mineral accumulation rates that were similar. They conclude that the use of mineral supplements in the care of preterm infants is effective in promoting their bone growth later in life.

Age-related cataract, vitamin B6, folate and taurine. Cataracts are responsible for over 50% of all blindness. By age 85 years, 45% of Americans develop visual impairment from cataract. Recent epidemiological studies have provided encouraging evidence that nutrition may play an important role in preventing cataracts. Researchers at the Human Nutrition Research Center at Tufts University, found that individuals with cataract had lower intakes of folate and vitamin B6 than persons of comparable ages without cataract. To further explore the possible mechanism of action for these nutrients, researchers also examined plasma levels of homocysteine and taurine. Low folate and vitamin B6 intakes lead to elevated levels of homocysteine, which is believed to promote tissue damage; vitamin B6 is necessary for the production of taurine, which is found in the human lens in high concentrations and is believed to protect tissues against toxic insult. Individuals with cataract had substantially lower plasma levels of taurine. Homocysteine levels were similar in persons with and without cataract. Results indicate possible roles for folate, vitamin B6 and taurine in preventing cataract formation and imply a dietary function in delaying the process.

Vitamin C intake and blood pressure in the elderly. Elevated blood pressure (BP) is a powerful determinant of cerebrovascular and coronary heart disease. The importance of nutrition in the control of blood pressure is well documented, with obesity, dietary sodium, and alcohol being associated with higher BP, and increased intakes of potassium and calcium associated with lower BP. Since inverse associations between BP and vitamin C have also been reported, scientists at the Human Nutrition Research Center on Aging at Tufts University in Boston, Massachusetts, undertook an analysis of data from a large cross-sectional study of health and nutrition in a group of noninstitutionalized elderly subjects. They found half as many cases of elevated BP in subjects consuming 240 milligrams or more per day of vitamin C than they did in those consuming less than 60 milligrams per day. This finding lends support to the hypothesis that diets low in vitamin C are related to increased BP. However, further research is required to test whether the vitamin C itself--or some other component of a low vitamin C diet--is responsible for the elevated BP.

INTEGRATION OF AGRICULTURAL SYSTEMS

Current Activities: The solution of important national problems faced by agriculture requires the integration of components of research from all areas of the agricultural and natural resource system. These include soils, water, climate, plants, insects, diseases, animals, and people. A primary objective of systems research is to package research results into products that aid or improve the timeliness and accuracy of decisions made by managers of agricultural systems and their impact on society as a whole. Systems research can result in lower input costs, better quality products, more efficient resource use, reduced environmental impact, and improved sustainability of agricultural production systems to meet long-term societal needs.

Systems research teams are typically composed of scientists from several disciplines and are often stationed at more than one location. Team members are linked together through national information networks to share concepts and data bases required to build models. Mathematical models are one of several systems tools that can serve as surrogates for the real system on which experiments can be performed to estimate the system's response over time to alternative environments or management practices. It is usually not possible to perform such experiments on the real system because it is too costly, or requires too much time to obtain the results. The accuracy with which the models represent the real systems is tested through validation experiments. Validated models serve as predictors of system performance and can, therefore, be used in the decision making process as a tool to estimate how the system can best be managed to achieve desired goals.

Selected Examples of Recent Progress:

Computer model helps ensure clean water. Farm families and city dwellers alike are increasingly concerned that agricultural chemicals may be contaminating ground water in both rural and urban areas. In the past, farmers have fertilized to achieve high-yield goals and have paid less attention to nitrate leaching. A real possibility also exists that fertilizers used on lawns, gardens, and golf courses in urban areas may leach into groundwater supplies. Both rural and urban sources threaten groundwater contamination and require site-specific evaluation. That's where help from a computer program called Nitrogen Leaching and Economic Analysis Package (NLEAP) comes into play. It's a screening package designed to help individual farmers, Soil Conservation Service personnel, farm advisers, and homeowners determine if they have a potential nitrate leaching problem on an individual farm or site. The model, which is designed for personal computers, builds several types of information indexes to predict potential leaching of nitrate nitrogen and its impact on underlying aquifers. The model is adaptable enough to be used by other federal, state, and local agencies, or by farm consultants and state extension personnel. United States Department of Agriculture's Soil Conservation Service considers the NLEAP model one of its major tools.

Revised Universal Soil Loss Equation (RUSLE), has greatly enhanced the capability of field technicians to estimate soil loss by erosion, by using computer technology. The new technology, recently delivered to the Soil Conservation Service (SCS) by a team of Agricultural Research Service and SCS scientists, has large potential impacts on United States Department of Agriculture programs such as those associated with the 1985 Food Security Act (FSA), 1990 FACT Act and the National Resource Inventory (NRI). The accuracy of individual soil loss estimates is significantly improved as a result of the technology. In many cases, the projected soil loss is higher than that calculated using the old RUSLE. As a result, the technology is expected to alter the quantification of highly erodible land as used in FSA. The technology also permits evaluation of soil loss from crops for which soil loss ratios have not yet been determined experimentally.

Airborne video cameras can be used to determine perennial grass forage production, weed invasion and soil fertility. An Agricultural Research Service-developed airborne video system uses three video cameras, VHS recorders, and a computer to help ranchers, wildlife managers, and the Soil Conservation Service. Through the use of image processing software, land managers can accurately predict the production of six perennial grasses, the effectiveness of fire and chemicals in reducing weed populations, and map soil fertility levels on irrigated and nonirrigated lands. While airborne video won't completely replace aerial photography and satellite data, it provides real time information to land managers.

Weed management decision aid minimizes herbicide use, reduces pollution potential, and increases profits for corn producers. Weed control practices developed since World War II for corn production have encouraged farmers to apply prophylactic soil-applied herbicides in anticipation of weed problems. A weed management microcomputer model, developed at Fort Collins, Colorado, based on weed seeds and weed seedlings in fields, was developed to help producers choose the most profitable weed control strategy that minimizes herbicide use for irrigated corn. Over the last four years, this model has been tested on 50 selected farms in four Colorado counties. Between 1989 and 1991, the model recommended 12% less herbicide per acre, saving $5.90 per acre in herbicide and application costs, plus returning $9.60 per acre more net return than the farmer's weed management practices. Less herbicide reduces the potential to contaminate water and groundwater supplies.

Expert system for management of wheat diseases. An expert system has been developed to manage rusts and other diseases of wheat in the Pacific Northwest

(PNW). The program, referred to by the acronym MoreCrop (Managerial Options for Reasonable Economical Control of Rusts and Other Pathogens), was developed by scientists at Pullman, Washington. MoreCrop is designed to provide various disease management options in various agronomic zones of the PNW. Past managerial decisions and disease conditions are utilized to assist the user in deciding what disease control option to select. Although developed for the PNW, the principles and concept of MoreCrop should also apply to other regions and other crops. This program may serve as a prototype for a total wheat management program.

Computer model reduces feed cost. Quantitative information on nutrients available for absorption have hindered accurate prediction of productive ruminant performance for nutrients fed. In ruminant animals, feedstuffs are digested in the rumen prior to gastric and intestine digestion, and ruminant nutritionists have been unable to predict the end products of ruminal fermentation. A scientist located at Ithaca, New York, collaborated with scientists at Cornell University to devise a Net Carbohydrate-Protein System, a computer simulation which predicts the end-products of rumen digestion. This system allows farmers to select more efficient combinations of dietary ingredients because of decreased fermentation losses. The system has been evaluated and used by farmers, extension agents, and nutrition consultants. On one test farm (250 dairy cattle with an annual herd average of 25,000 pounds of milk) there was a $48,000 savings in feed per year.

Model developed to predict the temperature of grain during storage with aeration. To maintain grain quality during storage, grain must be protected from weather, insects and growth of microorganisms. Grain-infesting insects are sensitive to temperature in that they multiply slowly or not at all at temperatures below 60°F, generally cannot survive above 105°F, and thrive best at about 85°F. Grain temperature is a major factor which directly or indirectly affects the rate of insect and mold deterioration of grain during storage. Aeration of grain offers an excellent form of biologically sound preventative maintenance for insect infestation. A computer simulation model including forced aeration options was developed to predict the temperature of grain during storage. Predicted and measured grain temperatures were in close agreement in all regions of the test bins for an extended test period of 32 months. The model and parameter values used in the model are applicable for predicting the temperature distributions in stored wheat with and without aeration. The model permits the development and evaluation of aeration control strategies to optimally and efficiently maintain stored grain quality and reduce the need for chemical agents for insect and mold control. The model provides a way to include grain moisture predictions and convective air currents in stored grain quality control programs.

Microbial Food Safety (MFS) software updated. A computer program that provides estimates of how pathogenic foodborne bacteria are likely to behave in foods was updated. MFS Pathogen Modeling Program 3.1 is the fourth in a series of user-friendly programs developed by scientists at the Wyndmoor, Pennsylvania, laboratory. The new version includes both new organisms such as E. coli 0157 and an enhanced capacity for user friendly calculations. These make it easier for food technologists who design or evaluate foods to rapidly estimate how changes in food formulation and storage factors are likely to impact the microbiological safety of food products. The latest version of the program has been requested and provided to over 500 corporations and individuals worldwide.

AGRICULTURAL RESEARCH SERVICE

Buildings and Facilities:

For acquisition of land, construction, repair, improvement, extension, alteration, and purchase of fixed equipment or facilities as necessary to carry out the agricultural research programs of the Department of Agriculture, where not otherwise provided, [$34,514,000], $24,587,000 to remain available until expended (7 U.S.C. 2209b): Provided, That facilities to house bonsai collections at the National Arboretum may be constructed with funds accepted under the provisions of Public Law 94-129 (20 U.S.C. 195) and the limitation on construction contained in the Act of August 24, 1912 (40 U.S.C. 68) shall not apply to the construction of such facilities: Provided further, That funds may be received from any State, other political subdivision, organization, or individuals for the purpose of establishing any research facility of the Agricultural Research Service, as authorized by law.

AGRICULTURAL RESEARCH SERVICE

BUILDINGS AND FACILITIES

Appropriation Act, 1993	$34,514,000
Budget Estimate, 1994	24,587,000
Decrease in Appropriation	-9,927,000

SUMMARY OF INCREASES AND DECREASES
(On basis of Appropriation)

Facilities	1993 Estimated	Program Changes	1994 Estimated
Arkansas: National Rice Research Center, Stuttgart	$702,000	$-702,000	- -
California: U.S. Salinity Laboratory, Riverside	3,980,000	-3,980,000	- -
Western Regional Research Center, Albany	- -	+4,700,000	$4,700,000
Georgia: Poultry Disease Laboratory, Athens	677,000	+2,623,000	3,300,000
Illinois: National Center for Agricultural Utilization Research, Peoria	1,545,000	-1,545,000	- -
Iowa: National Pig Research Center, Ames	1,524,000	-1,524,000	- -
Louisiana: Southern Regional Research Center, New Orleans	1,651,000	+1,949,000	3,600,000
Maryland: Beltsville Agricultural Research Center, Beltsville	13,547,000	-3,547,000	10,000,000
Michigan: USDA Avian Disease Control Laboratory, East Lansing	212,000	-212,000	- -
Mississippi: National Center for Warmwater Aquaculture, Stoneville	931,000	-931,000	- -
National Center for Natural Products, Oxford	4,382,000	-4,382,000	- -
New York: Plum Island Animal Disease Center, Greenport	2,540,000	+447,000	2,987,000
Ohio: Demonstration Greenhouse, Lucas County	158,000	-158,000	- -
Oklahoma: Southern Plains Range Research Station, Woodward	146,000	-146,000	- -

Facilities	1993 Estimated	Program Changes	1994 Estimated
Texas: Plant Stress and Water Conservation Laboratory, Lubbock.....	1,101,000	-1,101,000	- -
Wisconsin: Cereal Crops Research Unit--Barley/Malt Laboratory, Madison.....	148,000	-148,000	- -
France: European Biological Control Laboratory, Montpellier............	1,270,000[1/]	-1,270,000[1/]	- -
TOTAL AVAILABLE..........	34,514,000	-9,927,000	24,587,000

[1/] Includes funding in connection with facilities in Parlier, CA, and Orlando, FL.

PROJECT STATEMENT
(on basis of available funds)

PROJECT	1992 Actual AMOUNT	1992 Actual Staff Years	1993 Estimated AMOUNT	1993 Estimated Staff Years	Increase or Decrease	1994 Estimated AMOUNT	1994 Estimated Staff Years
Total Obligations...	$53,294,137	- -	$41,500,000	- -	$+2,200,000	$43,700,000	- -
Unobligated Balances:							
Available, Start of year.	-47,607,426	- -	-59,877,289	- -	+6,986,000	-52,891,289	- -
Available, End of year.......	59,877,289	- -	52,891,289	- -	-19,113,000	33,778,289	- -
Total Available or Estimate..	65,564,000	- -	34,514,000	- -	-9,927,000	24,587,000	- -

BUILDINGS AND FACILITIES

(1) An net decrease of $9,927,000 for Buildings and Facilities, consisting of:

(a) A request of $10,000,000 for the modernization of facilities at the Beltsville Agricultural Research Center, Beltsville, Maryland.

Need for Change. The Beltsville Agricultural Research Center (BARC) was established in 1910. Current land resources total 7,000 acres and accommodate more than 800 buildings and structures in support of the full spectrum of ARS research programs, including: natural resources and environmental sciences, plant and animal productivity, product quality, and human nutrition studies. The ARS staff at Beltsville totals about 1,500, including 400 scientists.

BARC is the largest research center in ARS and is the largest agricultural research center in the world in terms of program scope and concentration of scientists. BARC has long enjoyed a worldwide image of preeminence in the agricultural scientific community because of its long history of research quality, contributions to agriculture, and prominent scientific expertise. It is the headquarters for ARS' national program leadership. In addition, 18 Federal agencies such as FDA, EPA, FGIS, and APHIS have offices or laboratories at BARC or facilities next to the Center.

However, most of the major ARS facilities and utility support systems at BARC were built in the 1930's and 1940's. Deterioration and obsolescence of these 50-year-old facilities are hampering both the scientific research and the image of BARC as the preeminent agricultural research center of the USDA. An architectural-engineering consultant which completed a comprehensive study on BARC in the late 1980's produced a modernization plan with cost estimates of $205 million for the total facility modernization of the Center, phased over an 11-year period.

ARS is currently implementing the BARC modernization plan which specifies the necessity to incorporate a mix of construction of new structures and renovation of existing facilities, including the demolition of over 200 outmoded structures.

The FY 1993 appropriation included funds of $13.5 million for BARC modernization. These funds are being utilized for the construction of the BARC-West Wastewater Treatment Plant, construction of Phases 2, 3 and 4 of the Range 2 Greenhouse modernization, design of the BARC-East Water Distribution System, design of a new controlled environmental facility for use as plant growth chambers, and funding for miscellaneous projects.

Nature of Change. Incremental funds of $10 million are needed in 1994 to continue with the vigorous implementation of the BARC modernization plan. The following modernization projects will require funding in FY 1994:

BARC-WEST Electrical Upgrade. The existing electrical distribution system at BARC-WEST is in need of major renovation/replacement based on a study conducted in FY 1992 to investigate the condition of the system. Based on the results of that study, a design was initiated in FY 1993. Construction, which is estimated at $2.2 million, is scheduled for award in FY 1994.

BARC-EAST Water Distribution System. The existing water distribution system at BARC-East is in need of major renovation/replacement of the distribution lines and wells and design was initiated in FY 1993. Construction, which is estimated at $7 million, is scheduled for award in FY 1994.

API-New Animal Building. This project involves replacing several outdated animal facilities at the Animal Parasitology Institute (API). A study was initiated in FY 1993 to determine whether the existing structures should be renovated or replaced. Design, which is estimated at $530,000, is scheduled for award in FY 1994.

Miscellaneous Projects. The design and construction of small projects included in the overall modernization plan which are scheduled for award in FY 1994 are estimated at $270,000, and include:

--Demolition of facilities.
--Parking lot and road repairs.
--Minor facility renovations to provide swing space for personnel displaced by other modernization projects.

(b) A request of $8,300,000 for the modernization of facilities at the ARS Regional Research Centers: Albany, California ($4.7 Million); New Orleans, Louisiana ($3.6 million).

Need for Change. Outmoded facilities severely limit the ability of ARS scientists to conduct advanced research. In addition, the Agency has experienced difficulties in attracting good scientists when introduced to old, deteriorated laboratory facilities. Existing facilities also contain numerous building and environmental code deficiencies. An investment of resources is essential to enable these Centers to regain the scientific capacity necessary to deliver viable and timely research discoveries that contribute to the development of new markets at home and abroad.

Due to the advanced age of these Centers, all major building systems--heating, ventilation, air-conditioning, electrical, roofs, and infrastructures (paving, steam and water lines, and waste treatment disposal systems)--have either reached or passed their useful life expectancy. Other prevalent facility deficiencies include safety and health requirements, such as asbestos removal and correction of building code upgrade requirements.

Nature of Change. Additional appropriations are required in FY 1994 to allow the Agency to proceed with the phased modernization efforts at the Western Regional Research Center (WRRC) at Albany, California, and the Southern Regional Research Center (SRRC) at New Orleans, Louisiana. Phased construction is necessary as individual laboratories, or wings of laboratories, are renovated due to the absence of swing spaces to house displaced scientists. The major modernization projects in FY 1994 for these two Centers are as follows:

WRRC Chemical Wing. Construction of Phase 6 of modernization program--$4.7 million. Construction will involve the renovation of laboratories, upgrading of utilities, new HVAC system, replacement of casework, upgrading of electrical systems, fire safety improvements to meet current codes, and asbestos abatement.

SRRC Chemical Wing. Construction of Phase 6 of modernization program--$3.6 million. The modernization of the Chemical Wing will involve the renovation of laboratories, new HVAC system, new casework, electrical upgrade, fire safety improvements to meet current codes, and asbestos abatement.

(c) A request of $2,987,0000 for the modernization of the Plum Island Animal Disease Center, Greenport, New York.

Need for Change. The Plum Island Animal Disease Center (PIADC) was established by an Act of Congress in 1954. It is located on a federally-owned 840-acre island located about two miles off the eastern tip of Long Island, New York. PIADC is the only site in the United States authorized by Congress to carry out research and diagnostic work on foreign animal diseases, which are an ongoing threat to the U.S. livestock industry; e.g., foot-and-mouth disease and African swine fever.

In 1989, ARS and APHIS began to develop an overall long-range plan for the repair and maintenance of the buildings and supporting infrastructure at PIADC. Engineering studies identified the need for repairs and improvements to correct major code violations and provide mandatory safeguards against power failures. Biosecurity depends on the proper functioning of equipment and power systems.

Based on these studies, total funding in excess of $90 million is needed for improvements at Plum Island over the next few years to bring the facilities into compliance with existing codes, as well as provide for appropriate workspace for advanced research and diagnostic activities on various foreign animal disease threats. Given the magnitude of the cost estimates, projects which must be completed in order to provide safe facilities for continued operation of Plum Island in the near term were selected for funding in FY 1994. Longer term facility requirements will be reviewed in the context of scientific advances and other operating considerations which may provide the basis for alternatives to continued operation of Plum Island in the long term.

Nature of Change. The additional funds will be used for environmental compliance projects requiring immediate repair or replacement, in compliance with Federal, State, and local environmental laws, regulations, and standards. Problems and concerns have been identified and plans are underway to provide corrective actions. It is critical that actual implementation begin no later than FY 1994 since daily fines or other legal actions by regulatory agencies are possible.

Wastewater Treatment Plant Improvement ($1,487,000). The existing treatment plant is in need of repair or replacement. None of the instrumentation is working and the pond liner has become brittle. Inspections by the Suffolk County Health Department and EPA have pointed out many deficiencies. A design for the repair or replacement of the system will be completed by the second quarter of 1994.

Above Ground Fuel Tank Repairs ($1,500,000) The existing 210,000 gallon fuel tank need upgrading to meet current regulations. A study was initiated in FY 1992 to determine the scope of repairs.

(d) A request of $3,300,000 for the construction of the Poultry Disease Laboratory Addition, Athens, Georgia.

Need for Change. New demands have been placed on USDA research facilities at the Southeast Poultry Research Laboratory with the outbreak of Avian influenza in Pennsylvania, Virginia, and Maryland in 1983 and 1984. This research laboratory carries out the primary effort in ARS to solve Avian disease problems associated with pathogens of foreign origin. This facility will meet both immediate and long-range needs to allow ARS scientists to address the urgent problems in lethal Avian influenza and exotic Newcastle disease for use by action agencies and the poultry industry. The facility is of national importance since research for these two exotic avian diseases is restricted to only the highest animal containment laboratories. The addition of this facility will meet high-containment needs to house research on highly lethal avian influenza.

Nature of Change. The new facility will provide about 16,000 square feet and will be a one-story structure containing animal holding and laboratory spaces designed to safely contain the most hazardous of poultry pathogens. ARS was appropriated $400,000 in FY 1992 for the planning and design of the facility. An additional $677,000 was appropriated in FY 1993 for facility construction. ARS is requesting an increase of $3.3 million in FY 1994 to provide for the balance of construction funds for the facility, designed primarily to house infected poultry as well as the necessary support laboratories to carry out essential research on Avian influenza, concurrent with exotic Newcastle disease research efforts in the present containment space. This facility would provide for a more comprehensive program of research to solve exotic diseases in poultry. The full cost of construction of this facility is projected at $4.5 million, including the $500,000 committed by the Poultry Association towards the purchase of necessary equipment for the new laboratory.

(e) A decrease of $34,514,000 to delete funds provided in the FY 1993 Appropriation Act.

Need for Change. Funds for projects contained in the FY 1993 Appropriation Act are available until expended and are not required in FY 1994.

Agricultural Research Service
Status of Construction Projects as of March 1993

Status of research facilities authorized or funded in prior years and reported as uncompleted in the 1993 Explanatory Notes, is as follows:

NOTE: Design criteria, provided by ARS, specifies the program requirements for the facility and forms the basis for negotiation of architect-engineer contracts. Diagrammatic drawings or concept drawings provide the basis for the first review of the architect's design. Tentative drawings or architect's design are provided by the architect for firming up cost estimates and basis for developing the completed, and final working drawings.

Location and Purpose	Year	Amount of Funds Provided	Description
Arkansas, Stuttgart Rice Research Center	1991 Planning	$222,997	Design contract was awarded in the Fourth Quarter of FY 1992 for completion by the First Quarter of FY 1994.
	1992 Planning	729,000	
	1993 Construction	702,000	
	Total	1,653,997	
California, Riverside U.S. Salinity Laboratory	1987 Planning	1,000,000	Construction contract was awarded in the Fourth Quarter of FY 1992 for completion by the Fourth Quarter of FY 1994.
	1989 Construction	900,000	
	1990 Construction	2,000,000	
	1991 Construction	5,049,934	
	1992 Construction	5,300,000	
	1993 Construction	3,980,000	
	Total	18,229,934	
Colorado, Ft. Collins National Seed Storage Laboratory	1988 Planning	1,000,000	Construction of the new laboratory has been completed. Renovation of the old laboratory will be completed in the Third Quarter of FY 1993.
	1989 Construction	2,750,000	
	1990 Construction	5,500,000	
	1991 Construction	2,999,961	
	Total	12,249,961	
District of Columbia U.S. National Arboretum, Brickyard Upgrade and New York Avenue Entrance Upgrade	1989 Reprogrammed for Planning and Construction	2,000,000	The construction of the New York Avenue entrance and parking lot was completed in the Third Quarter of FY 1992. Design was awarded for the brickyard restoration project in the Second Quarter of FY 1993. Phase I of construction, including asbestos abatement and stabilization of two kilns and two stacks, is scheduled in the Fourth Quarter of FY 1993.

Status of Construction Projects as of March 1993 (con't.)

Location and Purpose	Year	Amount of Funds Provided	Description
Water System Upgrade	1992 Planning	$400,000	Design contract was awarded in the Fourth Quarter of FY 1992 for completion by the Third Quarter of FY 1993.
Florida/Hawaii Emergency Relief	1992 Planning and Construction	15,000,000	The restoration of these facilities is currently in progress. The scheduling and cost estimates of specific work required to restore the facilities and grounds are being developed at this time.
Georgia, Athens Poultry Disease Laboratory	1992 Planning	400,000	Design contract was awarded in the Third Quarter of FY 1992. Construction will not be initiated until the project is fully funded.
	1993 Construction	677,000	
	Total	1,077,000	
Illinois, Peoria National Center for Agricultural Utilization Research	1992 Planning	1,825,000	The design of the Pilot Plant and the Semi-Works Building will be completed in the Third Quarter of FY 1993.
	1993 Planning	1,545,000	
	Total	3,370,000	
Iowa, Ames National Animal Disease Center, Necropsy	1991 Planning	299,996	The design for a stand-alone necropsy facility with an incinerator is scheduled for completion in the Third Quarter of FY 1993. Construction will not be initiated until the project is fully funded.
National Pig Research Center	1992 Planning and Construction	1,800,000	Pre-design contract was awarded in the First Quarter of FY 1993. Design contract is scheduled for award in the Third Quarter of FY 1994 for completion by the First Quarter of FY 1996.
	1993 Planning and Construction	1,524,000	
	Total	3,324,000	

Status of Construction Projects as of March 1993 (con't.)

Location and Purpose	Year	Amount of Funds Provided	Description
Louisiana, New Orleans Southern Regional Research Center	1992 Construction	1,950,000	Design was completed. Facility modernization is being undertaken in phases due to the need to continue research programs during the renovation period. Phase I of construction was completed in the First Quarter of FY 1992. Phase II of construction was completed in the Second Quarter of FY 1993. Contracts for construction Phases III, IV, and V were awarded in the Fourth Quarter of FY 1992. Each phase requires one year for completion. The FY 1993 appropriation of $1,651,000 will be utilized for design and construction of site repairs consisting of roads, curbing, drainage, etc. Design contract was awarded in the Second Quarter of FY 1993.
	1993 Planning and Construction	1,651,000	
	Total	3,601,000	
Maryland, Beltsville BARC Modernization of Facilities	1988 Modernization	$5,750,000	Completed Projects: 1988 Funds: Design and Construction: -- Clean and Reline Waterline Systems -- Renovate Bldgs. 264, 303, 306, 307 and 476 Design: Renovation to Bldg. 007, Phases I and II Design: Renovation to Bldgs. 003 and 204
	1989 Modernization	6,100,000	1989 Funds: Construction: -- Renovation to Bldgs. 003 and 204 -- Renovation to Bldg. 007, Phases I and II Design and Construction: -- New Small Animal Facility -- Pesticide Handling Facility -- New Boar House (Bldg. 203) Design: -- Repair/Replace Steamlines
	1990 Modernization	9,860,000	
	1991 Modernization	15,999,792	
	1992 Modernization	16,000,000	
	1993 Modernization	13,547,000	
	Total	67,256,792	

Status of Construction Projects as of March 1993 (con't.)

Location and Purpose	Year	Amount of Funds Provided	Description
			1990 Funds:
			Construction:
			-- Repair and Replace Steamlines
			Design:
			-- Repair Powder Mill Road
			-- Upgrade Electrical Distribution System
			-- Design Range 2 Greenhouse Phases I, II and III.
			1991 Funds:
			Design and Construction:
			-- Commodity Storage (Central Hay Storage) Facility
			-- Waste Water Treatment Phase I - Pumping Stations East
			-- Building 005 Conference Room Addition
			Design:
			-- Dairy Research Facility
			-- Waste Water Treatment Phase 2 - Facility East
			-- (Study) Bldg. 426 Addition
			-- Bldg. 200 and 201 Facility Condition Study
			-- Renovation Bldg. 001
			-- New Plant Sciences Building
			Ongoing Projects:
			1990 Funds:
			Construction:
			-- Repair Powder Mill Road Completed in the First Quarter of FY 1993.
			-- Upgrade Electrical Distribution System Completion scheduled for the Third Quarter of FY 1993.

Status of Construction Projects as of March 1993 (con't.)

Location and Purpose	Year	Amount of Funds Provided	Description
			1992 Funds: Construction: -- Waste Water Treatment Facility Phase 2 East scheduled for completion in the Fourth Quarter of FY 1993. -- Plant Sciences Facility construction began in the Second Quarter of FY 1993, to be completed in the Third Quarter of FY 1994. -- Range 2 Greenhouse Modernization (Phase I) scheduled for completion in the Third Quarter of FY 1993. -- Dairy Research Facility scheduled for completion in the Fourth Quarter of FY 1993. Design: -- Waste Water Treatment Facility West, scheduled for completion in the Third Quarter of FY 1993.
			Planned Projects: 1993 Funds: Design and Construction: -- Water System Upgrade Design completion and construction award scheduled for the Fourth Quarter of FY 1993. Design: -- (Study) Animal Office/Laboratory consolidation including APU using cluster concept. Scheduled for award in the Third Quarter of FY 1993. -- Controlled Environmental Facility scheduled for award in the Third Quarter of FY 1993. -- Upgrade BARC-West electrical system scheduled for award in the Third Quarter of FY 1993.

Status of Construction Projects as of March 1993 (con't.)

Location and Purpose	Year	Amount of Funds Provided	Description
			Construction: -- Waste Water Treatment Facility West scheduled for award in the First Quarter of FY 1994. -- Design adjustments for combining Phases II, III, and IV to be completed in the Third Quarter of FY 1993 and construction to be awarded in the Fourth Quarter of FY 1993.
Michigan, East Lansing Regional Poultry Research Center	1992 Planning	$250,000	The pre-design contract, including an Environmental Assessment utilizing both FY 1992 and FY 1993 funds, was awarded in the Second Quarter of FY 1993. The FY 1993 appropriation will be used to continue with pre-design of the project which consists of four phases.
	1993 Planning	212,000	
	Total	462,000	
Minnesota, Morris Soil and Water Laboratory	1991 Planning	$299,996	The design of the facility is underway.
	1992 Construction	825,000	
	Total	1,124,996	
Mississippi, Oxford National Center for Natural Products	1988 Feasibility and Planning	50,000 a/	Facility is under construction with the foundation and shell scheduled for completion in the Second Quarter of FY 1993.
	1989 Planning	400,000 a/	
	1990 Planning and Construction	3,875,000 b/	
	1991 Construction	5,174,933 a/	
	1992 Construction	5,175,000 a/	
	1993 Construction	4,382,000 a/	
	Total	19,056,933	
Mississippi, Stoneville National Center for Warm Water Aquaculture	1991 Planning and Construction	1,199,985 c/	Construction contract has not been awarded due to excessive bids received. Bidding has been re-opened in an attempt to secure lower bids.
	1992 Construction	1,100,000 c/	
	1993 Construction	931,000 c/	
	Total	3,230,985	

Status of Construction Projects as of March 1993 (con't.)

Location and Purpose	Year	Amount of Funds Provided	Description
New York, Greenport Plum Island Animal Disease Center Consolidation of Facilities	1981 Building 257 Construction Redirection	1,200,000	Construction contract awarded in the Fourth Quarter of FY 1992 covering the renovation of Building 101 and the building addition to consolidate ARS and APHIS programs on the Island. Construction is scheduled to be completed in the Fourth Quarter of FY 1994.
	1989 Construction Default Settlement	7,805,398	
	1990 Default Interest	3,006,003	
	1991 APHIS share of Consolidation	5,241,450	
	1992 APHIS share of Consolidation	1,496,000	
	1992 ARS Construction	3,000,000	
	Total	21,748,851	
Modernization of Facilities	1993 Design and Construction	$2,540,000	Building 101 Chiller Replacement design was completed in the First Quarter of FY 1992. Construction award is anticipated in the Third Quarter of FY 1993.
			Design contract for above- and below-ground fuel storage tank replacements will be awarded in the Third Quarter of FY 1993.
			A construction contract for sludge removal will be awarded in the Fourth Quarter of FY 1993.
North Dakota, Fargo Plant Science Greenhouse Complex, North Dakota State University	1991 Planning and Construction	424,995	The design of the greenhouse complex was completed in the Third Quarter of FY 1992. Solicitation for construction bids issued in the Fourth Quarter of FY 1992 exceeded funds available and the solicitation was cancelled. Re-design was completed in the First Quarter of FY 1993, with a construction award anticipated in the Third Quarter of FY 1993.

Status of Construction Projects as of March 1993 (con't.)

Location and Purpose	Year	Amount of Funds Provided	Description
Ohio, Lucas County Demonstration Greenhouse	1992 Planning and Construction	187,000[c/]	Funds will be provided through a grant award in FY 1993.
	1993 Construction	158,000[c/]	
	Total	345,000	
Oklahoma, Lane South Central Agricultural Research Center Phase III Construction	1989 Planning	140,000	Construction of Phases IIIA and IIIB will be completed in the Fourth Quarter of FY 1993.
	1990 Planning	150,000	
	1991 Construction	1,449,981	
	1992 Construction	1,725,000	
	Total	3,464,981	
Oklahoma, Woodward Greenhouse for the Southern Plains Range Research Station	1992 Planning and Construction	173,000	Design was completed in the Second Quarter of FY 1992. Construction of the greenhouse was awarded in the Fourth Quarter of FY 1992 and was completed in the First Quarter of 1993. FY 1993 appropriated funds will be utilized for design and construction of a headhouse.
	1993 Design/ Construction	146,000	
	Total	319,000	
Oregon, Corvallis Northwest Small Fruit Center	1990 Feasibility Study	$50,000	Design contract was awarded in the Second Quarter of FY 1992 for completion by the Third Quarter of FY 1993. A construction contract will be awarded in the Fourth Quarter of FY 1993.
	1991 Planning	174,998	
	1992 Construction	1,900,000	
	Total	2,124,998	
South Carolina, Charleston U.S. Vegetable Laboratory	1988 Feasibility	50,000	A contract for design of Phase I of the facility was awarded in the Third Quarter of FY 1991 and will be completed in the Third Quarter of FY 1993.
	1990 Planning and Construction	1,135,000	
	Total	1,185,000	
Texas, Lubbock Plant Stress and Water Conservation Laboratory	1978 Feasibility	100,000	Construction of Phase I-Headhouse/Greenhouse will be completed by the Third Quarter of FY 1993. A contract for Phase II-main Laboratory/Office Building design was awarded in the Third Quarter of FY 1992 for completion by the Third Quarter of FY 1993. Construction of Phase II will not begin until construction has been fully funded.
	1979 Planning	800,000	
	1984 Planning	500,000	
	1990 Construction	500,000	
	1991 Planning	599,992	
	1992 Construction	1,300,000	
	1993 Construction	1,101,000	
	Total	4,900,992	

Status of Construction Projects as of March 1993 (con't.)

Location and Purpose	Year	Amount of Funds Provided	Description
Texas, Weslaco ARS Bee Laboratory	1990 Planning	340,000	A construction contract was awarded in the Third Quarter of FY 1992 with completion expected by the First Quarter of FY 1994.
	1991 Construction	1,699,978	
	1992 Construction	1,700,000	
	Total	3,739,978	
Washington, Yakima U.S. Fruit and Vegetable Laboratory	1988 Planning	1,000,000	Design of facility is scheduled for completion by the Third Quarter of FY 1993. Construction contract is scheduled for award in the Fourth Quarter of FY 1993 with completion anticipated by the Fourth Quarter of FY 1995.
	1989 Construction	900,000	
	1990 Construction	1,000,000	
	1991 Construction	5,049,934	
	1992 Construction	5,050,000	
	Total	12,999,934	
Wisconsin, Madison Greenhouse for the Cereal Crops Research Unit, Barley and Malt Laboratory	1992 Planning and Construction	175,000	Pre-design contract to be awarded in the Fourth Quarter of FY 1993.
	1993 Construction	148,000	
	Total	323,000	
ARS Facilities, Miscellaneous	1993 Relocation	$1,270,000	The 1993 appropriation provides that these funds be used for relocation of three laboratories: Montpelier, France; Parlier, California; Orlando, Florida. The following projects will be undertaken in FY 1993 using these funds: (1) Pre-design of the new laboratory at Parlier, CA; (2) planning and design of the new laboratory at Montpelier, FR; 3) master plan and environmental assessment of the new site for the Orlando laboratory.

Footnotes:
a/ Appropriated to ARS and transferred to CSRS.
b/ Appropriated to CSRS.
c/ Grant Award.

AGRICULTURAL RESEARCH SERVICE

Passenger Motor Vehicles

The passenger motor vehicles of Agricultural Research Service (ARS) are used almost exclusively by professional research investigators and technical personnel. In the course of their daily work these personnel may need to travel to field plots, demonstration sites, watersheds, other research work sites, individual farms, ranches, commercial firms, State agricultural experiment stations, etc. In this type of work a high degree of mobility is required.

It is the policy of ARS to pool the use of motor vehicles for different activities in order to keep the number of vehicles to a minimum and reduce overall costs of maintenance. Monthly vehicle operation reports are required and periodic surveys are made to determine the extent to which vehicles are being used and their condition.

Replacement of passenger motor vehicles.

It is proposed to replace 46 of 462 vehicles currently in operation. These vehicles are located at field stations and are used in connection with research studies and technical assistance. Vehicle replacement is based on funding priority, program management, mileage, and age eligibility.

Age and Mileage Data for passenger-carrying vehicles on hand as of September 30, 1992.

Age-Year Model	Number of Vehicles*	Percent of Total	Lifetime Mileage (thousands)	Number of Vehicles	Percent of Total
1987-or older	369	80	100 and above	22	5
1988	19	4	80-100	52	11
1989	23	5	60-80	80	17
1990	25	5	40-60	127	27
1991	15	3	20-40	93	20
1992	11	3	Under 20	88	20
Total	462	100		462	100

* Includes six vehicles used in foreign countries and six buses.

Aircraft

The Agency currently maintains a fleet of seven owned aircraft, located at College Station, Texas, and Weslaco, Texas. These specially modified and equipped research aircraft are used in pest control methods, application of agricultural materials, radar tracking of airborne insect migration, infrared and color photography, and evaluating effects of weather on agriculture.

THURSDAY, MARCH 11, 1993.

ALTERNATIVE AGRICULTURAL RESEARCH AND COMMERCIALIZATION (AARC)

WITNESSES

RALPH W.F. HARDY, MEMBER, BOARD OF DIRECTORS, AARC CENTER

PAUL F. O'CONNELL, DIRECTOR, AARC CENTER

STEPHEN B. DEWHURST, BUDGET OFFICER, DEPARTMENT OF AGRICULTURE

OPENING REMARKS

Mr. PETERSON. As you can see, we have a vote coming on. So if you could, perhaps, put your statements in the record and maybe abbreviate your positions, and that will put us to the time when we can go vote. And we will give you a break before responding to any questions we may have for you.

At this point in the record we will insert Dr. Hardy's and Dr. O'Connell's biographical sketches.

[The biographical sketches follow:]

RALPH W. F. HARDY 1/30/92

EDUCATION: BSA University of Toronto -- Chemistry, 1956
MS University of Wisconsin -- Biochemistry, 1958
PhD University of Wisconsin -- Biochemistry, 1960

POSITIONS:

University of Guelph--Asst Prof. 1960-63
E.I. du Pont de Nemours & Co., Wilmington, DE -- Research Biochemist, 1960, 1963-67; Research Supervisor, 1967-74; Associate Director, 1974-79; Director Life Sciences, 1979-84;
BioTechnica International, Inc., Cambridge, MA-- President, 1984-86; Deputy Chairman, 1986-1990. Board Member and Consultant, 1990-present.
Bio Technica Diagnostics, Inc., Cambridge, MA-- Chairman, 1985-87.
Cornell University, Ithaca, NY-- Visiting Professor, Life Sciences, 1984-86.
Boyce Thompson Institute for Plant Research at Cornell, Ithaca, NY-- President, 1986-present.

PROFESSIONAL ACCOMPLISHMENTS:

Biochemistry, physiology, agronomy of biological N_2, fixation -- enzymology, mechanism, assay, electron donors (ferredoxin, flavodoxin), photosynthetic limitation, energetics.
Crop growth - canopy CO_2 and yield, O_2, seed growth and assimilate partitioning.
Architect and implementor -- DuPont corporate R&D drive diversification in Life Science.
Established two start-up biotechnology companies with focus on dental diagnostics and agricultural inputs.
Technical publications (100+), invited presentations (300+), national and international committees, panels and boards, media interactions.
Academic, industry, and government interface.

PROFESSIONAL MEMBERSHIPS:

American Chemical Society
(Executive Committee and Secretary Biological Division, 1978-81)
American Society of Plant Physiologists
(Executive Committee, Board of Trustees, and Treasurer, 1974-77)
American Association for the Advancement of Sciences
American Institute of Biological Sciences
American Institute of Chemists (Fellow)
American Society of Agronomy
American Society for Microbiology
American Society for Biochemistry and Molecular Biology
New York Academy of Sciences

DR. PAUL F. O'CONNELL

Paul F. O'Connell was appointed as the initial Director of the Alternative Agricultural Research & Commercialization (AARC) Center in 1992. This is an independent entity within USDA with policy direction provided by a 9-member Board of Directors, 7 of whom are from the private sector. As Director, Dr. O'Connell is responsible for day-to-day management of the AARC Center. The AARC Center's mission is to expand industrial (non-food, non-feed) uses of agricultural based materials. The four major functions are to: be a facilitator; encourage private-public partnerships; fund promising projects; and serve as a information clearing house.

Prior to his current appointment, Dr. O'Connell served as Deputy Administrator for the Cooperative State Research Service (CSRS), U.S. Department of Agriculture. He provided leadership for national programs whose objectives were to find alternative opportunities for U.S. farmers. Major program areas included sustainable agriculture, industrial uses, aquaculture, and small-scale farming.

Prior to his tenure as Deputy Administrator of CSRS, Dr. O'Connell served for 3 years as Special Assistant to Orville G. Bentley, Assistant Secretary for Science and Education of USDA. Earlier professional experience involved 14 years with the Forest Service; 2 years with the Economic Research Service; and 3 years in the private sector. With these organizations, Dr. O'Connell served as Assistant Director, Project Leader, and Economic Analyst in Wisconsin, Arizona, and Minnesota.

Dr. O'Connell earned his B.S. degree from the University of Minnesota, majoring in Biochemistry and Dairy Science. He obtained two master degrees--one from Colorado State University and one from the Wharton School, University of Pennsylvania. These were in Agriculture Economics and Business, respectively. His Ph.D. degree was earned from the University of Wisconsin. He has received the USDA Superior Service Award, several cash awards, and certificates of merit. He is author or co-author of publications in science and education policy, natural resource issues, and commercialization of promising technologies.

September, 1992.

(Clerk's note.—Dr. Hardy's prepared statement appears on pages 213 through 222. Dr. O'Connell's prepared statement appears on pages 234 through 244. The Explanatory Notes appear on pages 245 through 255.)

Mr. Peterson. Dr. Hardy, you might proceed.

STATEMENT OF DR. HARDY

Dr. Hardy. Mr. Chairman and Members of the subcommittee, On behalf of the AARC board, I want to thank you for the opportunity for Paul O'Connell, who is director of the AARC program, and myself to give you a brief status report on the first year of operations of the Alternative Agricultural Research and Commercialization Center.

A couple of brief comments on my background. I have spent my career, basically, in the private for-profit, not-for-profit sector; 22 years at DuPont as director of life sciences for their agri-chemical health care chemical businesses; president of a biotech company which is developing a new seed business in the midwest; and I am president of a not-for-profit research institute.

I am delighted to see what we have created in AARC. In the testimony I gave in December 1987, I urged the Congress at that time to think about the opportunities that existed for new industrial uses in the agricultural arena.

Basically, what we are trying to do in the AARC Program is to make it happen which is our motto. The AARC is a board of nine individuals, with commercial, financial, producer, scientific, and technology interests. One is from government, one from academia, and seven from the private sector. Basically I think the board can be described as composed of a group of successful entrepreneurs.

The AARC was formed about a year ago and it was authorized in the Food, Agriculture, Conservation, and Trade Act of 1990. The previous Secretary appointed the members in March of 1992. We held our first meeting in April. Martin Andreas, of Archer Daniels Midland, was elected as the chair. We appointed Paul O'Connell as an acting director. As we became satisfied that Paul was the right person to manage the day-to-day operations of this, we appointed him as the director.

We held public hearings at eight different locations around the country to get input before we set policy. We heard from more than 200 people representing many segments of agriculture. Basically, we were urged by those people to make alternative agriculture uses happen, as you have been discussing in the previous testimony.

We heard that AARC should be a catalyst, a coordinator, and a facilitator to seek new industrial uses, for traditional and new crops, animal by-products, and forestry materials. We heard that we need more underpinning research in this area, and I concur with that; but we heard even more so that the whole area of technology transfer, that pre-commercialization phase, is the phase that most needs help at that stage. That is clearly what we have focused on.

AARC STRATEGIC PLAN

We have put together a strategic plan. I think you all have a copy of this document. And in the previous testimony, there were questions about, do we have performance measurements? And if you look at page 8 of that document, in fact, there is a listing we put together as to how we evaluate proposals in terms of whether AARC should provide funding for that or not.

We are sitting, I think, at a very unusual time in this area. There have been attempts to create new agricultural uses in the past. The technology really wasn't there in the past as it is there today. We are living in the era of biology at the moment. It is not the era of chemistry. It is not the era of physics. Those areas are less pregnant with opportunity. But biology, clearly, is an area where there are new major opportunities. And the use of that biology can, I think, drive us to major new economic industrial products from bio-materials, chemicals, commodity chemicals, specialty chemicals, liquid fuels, and polymers.

Mr. PETERSON. Dr. Hardy, if I could interrupt, in fairness to you—obviously, you have a longer statement—let us go vote, and we will come back and proceed after that, if you will.

Thank you.

Dr. HARDY. Okay. Thank you.

[Brief recess.]

Mr. DURBIN. [Presiding] If we could reconvene at this point. I apologize for being gone to testify on another subcommittee, but I would like the folks from the Alternative Agricultural Research and Commercialization Center to continue their testimony, and then we will ask some questions.

Dr. HARDY. Thank you. The point I was making when we broke was that we have new technologies and new scientific tools to make new industrial uses possible in the 1990s that were not possible to do in the 1930s, 1940s, and so on when this area had been previously visited.

I think it is important to recognize we are living in the area of biology. Biology is the dominant science at this stage. It is not chemistry. It is not physics. There are major new discoveries in science, and they are coming out of biology. And it is these discoveries that will provide us the tools to produce economic industrial products from bio-materials.

The types of materials that we see coming are chemicals. They can be commodities. It could be specialty chemicals, liquid fuels, polymers and fibers, composites, materials.

One example, and I spent many years in DuPont, was the discoverer of nylon back in the late 1920s. I think it is fair to say that the nylons of the future will probably be manufactured by green plants, grown in farmers' fields, utilizing our natural resources of sun, atmospheric carbon dioxide, and the soil and that consume carbon dioxide from the atmosphere, not adding carbon dioxide to the atmosphere.

CURRENT ACTIVITIES

The AARC Board has been in existence for a year. We have created a policy statement which we have referred to. In August 1992

we called for pre-proposals in the Federal Register. We received 407 proposals by October 31st. Those were reviewed. AARC Board members were involved in that peer review. Forty-plus were selected for full proposals. For some of those we had direct meetings with individuals prior to the decision-making.

From those 40 full proposals, last week, the AARC board selected 10 to 20 which we will visit and negotiate for funding. Board members are very involved in this activity. By my estimate, each board member has spent in excess of 20 days during the last year in direct involvement in the AARC activities.

EXAMPLES OF PROJECTS

I would like to share with you some examples of projects that we will possibly fund. One exciting one is a soybean protein combination with waste paper.

Dr. O'CONNELL. That is this one right here. This is made from soybean protein and waste paper with some other products. It is 40 percent soybean meal, 40 percent waste paper, plus other ingredients. It is a very attractive product that looks like marble.

Mr. DURBIN. Is that what is called a "new form?"

Dr. HARDY. Yes, New Stone. The potential market is a building material.

Mr. DURBIN. Let me stop you and ask you—tell me, is that price competitive with what is on the market?

Dr. O'CONNELL. Yes, it is. From a price standpoint, this looks very promising. Its main competition would be with lumber products and so forth. The people that are working on it have indicated that they can compete very well with the kind of products that it would be competing with.

Mr. DURBIN. What does it offer?

Dr. O'CONNELL. Well, first of all you can see it is a decorative sort of thing. From that standpoint, it would be attractive for internal use, for paneling and flooring and countertops and that sort of thing. From that standpoint, it has some advantages.

It does have some cost advantages also, as we understand it. And it is one of the projects we will be negotiating with them on.

One of the concerns that we have is will it stand up under different conditions, you know, under water and those kind of things. But that is one of the key things that AARC will be providing and working with them on to make sure that it will meet specifications for its use. So the initial indication is that it has a fair number of markets out there and it is cost competitive. Whether it will stand up under various uses we will have to see.

Mr. DURBIN. If you want to try it in different climatic extremes, you might try Mr. Myers' farm in Indiana.

Mr. SKEEN. Wet or dry.

Mr. DURBIN. Let me ask you this; does it use recycled print or news print?

Dr. O'CONNELL. Yes. It is waste paper that you would throw in the landfill and soybean meal, which we have plenty of.

Mr. DURBIN. Thank you.

Dr. HARDY. That is one example. We have a few other examples we would like to bring to your attention.

BIODEGRADABLE OIL

A second one is a biodegradable oil for equipment lubrication, initially, in marine and forest involvement.

Dr. O'CONNELL. Who said oil and water don't mix? I am going to put this in here and then take one of these good congressional pencils here and mix this up; and that will stay like that.

But you see, that mixes up very well. We can use this for cutting oil and in a marine environment. Rather than having petroleum that will cause problems, we can use this kind of a product and it will break down very quickly.

Mr. DURBIN. Excuse me. I am interested in whether it is price competitive with what is on the market?

Dr. O'CONNELL. Yes. They are already selling this cutting oil on the market right now.

Another product from the same company is rape-seed oil and this is for transmission fluid. The individual that is doing this, say this is the first year he turned a profit. So he is actually making money.

Mr. SKEEN. Cutting oil. Is it recyclable?

Dr. O'CONNELL. Yes. It could be if you needed to.

Dr. HARDY. It is probably going to be a biodegradable material. It is a plant oil, and plant oils are normally subject to biodegradation. So the attractiveness here is using it in environments such as marine and forest environments where it can biodegrade.

Mr. MYERS. It is recycled naturally then, right?

Dr. HARDY. Exactly.

Mr. SKEEN. You said it is cutting oil and plants use cutting oil. They recycle it?

Dr. O'CONNELL. Well, they recycle for a while, and then they throw it away.

Mr. SKEEN. But you never wear oil out.

Dr. O'CONNELL. But it gets contaminated.

Mr. SKEEN. Impurities, that is all?

Dr. HARDY. The third example is a windshield washer fluid that is made from agricultural material.

Dr. O'CONNELL. We were supposed to get in a jug of this. It is just out of ethanol rather than out of methanol.

Mr. MYERS. Here it comes right now.

Dr. O'CONNELL. Boy, talk about timing.

Mr. SKEEN. You can't even see it.

Mr. MYERS. It is made out of ethanol?

Dr. O'CONNELL. Yes. We asked them to ship it here, and they didn't want to ship ethanol in the mail. So that is the actual bottle it comes in. It is made out of ethanol.

Dr. HARDY. There is a lot of ingenuity out there, I think, is what these examples are showing you.

A fourth example is a starch-based polymer for food packaging and personal care items.

Dr. O'CONNELL. These are on the market, and they are—in fact, Mr. Chairman, in your State. Novon has a plant up in Rockford producing these. And these are becoming rather common. This will break down right in water.

Mr. SKEEN. Packing materials?

Mr. O'CONNELL. Yes, packing materials. A number of companies have these on the market now, and they are competitive and doing very well.

Mr. DURBIN. And they are made from——

Dr. O'CONNELL. Starch.

Mr. DURBIN. Corn starch.

Dr. O'CONNELL. Yes. These are about 98 percent starch.

Mr. HARDY. A fifth and final example, future ethanol from cellulosic materials, waste materials, like straw or it could be from grasses, where we think there could be significant cost advantages, and there are a large amount of unused materials available. I don't think we have an example.

Dr. O'CONNELL. No, we don't.

Dr. HARDY. But we are talking about major opportunities.

When I headed up life science in DuPont in the early 1980s, we had major activities in that area. Technology wasn't there. It looks like new technology is emerging.

Mr. MYERS. Did you find a use for cockleburs? I could grow a good crop of those.

Dr. HARDY. I think, the capabilities that we have at the moment to manipulate and modify plants to meet needs out there are greater than we have ever had before. It is not unrealistic to think about a variety of things that could be used for new uses down the road.

Mr. MYERS. Mr. Chairman, I am going to have to leave. May I just interject something here?

You made fun of my farm. Last year—I often bring myself into this thing. But last year, about early August, I went down to look at the river bottom. I have a hundred acres in the Wabash River bottoms, beautiful soybean crop, but it had some cockleburs in it. And I talked to the farmers, all of the chemicals we put on there, why in the world do we have cockleburs? I just don't know.

Well, a week later I went down, I didn't know I had a crop there; all covered with beautiful water. I had a lake there. Three weeks later the river finally went down. The bean field, about this color here, those cockleburs just as green, thriving just as well.

I have talked to Purdue about crossing soybean and cockleburs, and then I won't have to come to this Committee and complain about the flood. So I am serious about using the cockleburs. It is very strong.

CONCLUDING REMARKS

Dr. HARDY. Let me make a few concluding comments. You know, ideas for new industrial uses have been around since the 1930s. There has really been no consistent effort to make them commercially viable. We have got, as I tried to get across the point, major new technologies to bring to play in this area for high value and use, economically advantageous products and processes that weren't available heretofore.

The opportunity, I think, is very, very large. The opportunity in this area, I think, is as large as the production opportunity in agriculture was and production research in the 1920s, 1930s, 1940s and 1950s.

Agriculture, forestry products, reduced imports of fossil fuels and other materials; and we are seeing examples in the proposals that have come in for that area, full use of our arable land.

I was in a meeting yesterday looking at corn out to 2020 and the great concern is that with increasing corn yields by 2020, unless we find new uses, we are probably going to need about half the acreage to produce the corn that we will need.

It is very critical to get additional uses, more environmentally friendly processes. We have mentioned biodegradability, reduce fossil fuel to atmospheric carbon dioxide, reduced agriculture supports, rural community economic opportunities, and reduced dependence on commodity crop exports. I think this is a major opportunity. I think the AARC Board, taking their time from all who have very, very busy schedules, indicates that we all think this is an important thing to do.

Thank you for your attention. And Paul will make a few comments.

Statement of Dr. O'Connell

Dr. O'Connell. Thank you very much, Mr. Chairman.

As director of the AARC Center, I value the opportunity to discuss activity under way in the AARC Center. And I envision considerable potential in this area to expand commercial use of agriculture materials. This includes new crops and animal by-products, forestry materials, and industrial products. So it is a vast cross-section of products that are available.

In testifying today I want to emphasize at the outset that the administration is currently formulating the President's fiscal year 1994 budget. Accordingly, I am not in a position to provide you with the administration's position on funding for specific programs. As soon as that is available, we will provide it to the committee.

I just want to indicate that in the past I have helped establish and administer programs such as Sustainable Agriculture Research and the Regional Aquaculture Centers. All of these as well as the CSRS Office of Agriculture Materials, which was spoken of earlier, all received high marks, I think, at the grassroots level.

But one point I want to make is I have seen the tremendous progress that can be made working cooperatively with the private sector. I can't overemphasize that enough. That is why this is going to work, because we are working with the private sector and they are out front. We are not trying to determine winners. We want the private sector to determine winners.

NEED FOR PRIVATE/PUBLIC PARTNERSHIPS

The challenge today is not a shortage of promising ways to convert renewable materials into useful products, although we always have to take that into account. One of the real problems we have is this gap between research results and getting a product on the market.

And Peter Cannon, from a Silicon Valley start-up company, as well as studies in the Department of Commerce, indicate that for every dollar spent in a lab on research for a project, $10 are required to develop the research, and $100 are required to bring pro-

duction on line. That is an aspect of our economy that we haven't given enough attention to.

In the areas we are talking about here, we are talking about identifying the market. That is one of the first things you have got to do. You must design the equipment. You have to test the products for performance and consumer acceptance. Like the "New Stone" product we have up there, that has to go through a lot of testing situations.

Regulatory clearance is needed. We are living in a modern society where people don't want pollution. And to get any plant under way requires regulation clearance. It is not just Federal regulation, it is also State and county regulations. Scaling up prototype equipment to commercial scale, verifying the technology performance on a commercial scale, developing technical, cost, price, and other economic data for financial institutions are needed.

When you go to the bank, Mr. Myers, as you well know, you have to have all this laid out. And when you are talking about new uses like we are talking about here, the financial institutions are always a little cautious about whether they should allow their money to be used for this.

That is where AARC comes into the picture. The rate of investment on these development activities for new uses of agriculture materials in the U.S. is lower than in Japan and in the European Community, in part because their governments give more support to commercialization.

Private firms, alone, cannot wait the 5 to 10 years it generally requires to obtain adequate returns. Generally, their time limit is two years or less.

In addition, many of these new uses have social benefits, which the private sector cannot be expected to finance, such as: substituting degradable materials for one-time use, in other words, you can degrade it, and you don't have to put it in a landfill; reducing air pollution in our congested cities; processing value added products to create jobs in rural America; and encouraging farmers to grow crops and animals for changing markets. These are some of the social benefits that have to be taken into account, and that is another reason for AARC.

I just want to indicate one case proposal that I think is very significant. Dr. Hardy just mentioned this here, but it is the biomass to ethanol facility. This is to operate a succession of biomass to ethanol facilities in conjunction with co-generation capability. In order to do this, the technology must be demonstrated on a commercial scale. By AARC being a partner in the first operation, the company can attract other business partners and convince financial institutions to borrow the money. For this particular project, which we are negotiating right now, it is a $1 million investment. The private sector is willing to put up $7 million.

You wonder, why do they need us? Why can't they do it on their own? It is a matter that if we come into it, then they can get other people to come into it.

Also built into this plan—and this is very important—for the AARC program, is that when it is successful, we plan to have an investment return to the revolving fund. So this is not a program where the government is just putting money out there and does not

see it again. We are talking about this money coming back. That is part of our legislation. In some cases, we will take an equity position; and we will receive more back than we put out there. So each one will be a little different as to how we do it.

The feedstock for this initial facility is waste wood and paper that now goes into landfills, plus switchgrass. Using conservative assumptions of feedstocks, chemicals, utilities, and product sales, the project is expected to produce net pre-tax revenues of $3.5 million and gross sales of $22.6 million. Using the current value of switchgrass as an example, this facility would add $10 in value in products like fuel-grade ethanol, feed, and carbon dioxide for every dollar of raw material cost. And in this particular facility about 47 workers would be employed, and indirect job creation would be much more.

But a key point of this kind of an operation is that the successful demonstration of this is enormous. Rather than using only corn as a source material of ethanol, cellulosic materials can be employed, such as your cockleburs. This market would create value for grass, legume, and tree crops that are now grown on CRP lands.

In other words, if we can show that this is really viable and the private sector people are willing to put money out there, then together we can do this and have a tremendous impact.

I have in my testimony the NewStone project. I won't go through that.

REGIONAL CENTERS

Let me just shift over to regional centers, because this is an area of great interest to a lot of people that want to have regional centers.

The AARC legislation provides for the establishment of two to six regional centers around the country once the annual appropriation exceeds $5 million. The AARC appropriation for 1993 is $7.25 million, and this year's conference agreement provides for the designation of two initial centers.

Based on my experience in Sustainable Agriculture, Aquaculture and other programs, there are reasons for doing that. You actually save program dollars by having these regional centers out there, especially since the host institution must share the cost of operating the center, which is the case in our legislation. When competitive programs are run in Washington D.C., I feel the costs are higher for the following reasons: business and panel review members must come to Washington at program expense, if you have them out there, they don't have to; program support is more expensive in Washington because there is more competition for office space and qualified people in the Washington area than in most parts of the country. With the regional centers you also have more opportunity for direct interaction with people out in the region.

On December 23, 1992, we put out a request for proposals for regional centers; and we received back on February 19th 14 proposals. Their primary responsibilities are to establish an advisory council composed of processors, marketers, producers, scientists, and financial interests; have the Advisory Council recommend the best opportunities to commercialize new, non-food, non-feed prod-

ucts that will contribute to economic growth in the rural areas of the region; and after going through a competitive process, make recommendations to the Board, on which projects within that region are the most favorable to fund. They would also monitor the projects.

In other words, we need to have, out there in the region and in the field, people that are on top of this. The only way this is going to be successful is if we follow up with these projects. These are cooperative agreements. These aren't grants. These are cooperative arrangements. This money is cooperative generally between us and a private partner, and many times State or regional funding. So it is very much a cooperative kind of project.

One of the things you might ask is, why are institutions so interested in becoming a regional center. Because you are not talking about a lot of money. But if a place is designated as a regional center, that is going to become a focal point for this kind of activity. That is the reason they want to have it. We are going to select the centers according to their ability to fully share in the administrative costs, the qualifications to carry out these activities, geographic distribution, and enthusiasm to do this. The regional centers are something that we see as a very critical part of this whole program. And we are just in the process of setting those up.

Concluding Remarks

Why should the taxpayers invest in these kind of partnerships? Research has shown that finding new uses for farm commodity program crops will reduce program payments, lessen farmers' reliance on programs, and generate benefits to consumers of the new product.

Taxpayers have a long tradition of funding agriculture research, and they have received impressive returns on their public investment. Most of this research has focused on increasing yields and reducing the costs of producing traditional crops, which in some cases ends up increasing the commodity program costs.

On the other hand, commercialization of new industrial uses increases demand for agriculture materials and, therefore, should reduce the need for Federal commodity program payments. In general, these farm-grown materials are environmentally friendly. Also, rural communities will benefit from this. We would be much better off finding value-added processes for products rather than exporting raw commodities such as feed grains, wheat, hides, and logs. So we are in the value-added business, adding net new demand for agricultural materials. There is every indication that we can be successful.

Thank you, Mr. Chairman, for the opportunity to present this information.

REGIONAL CENTERS

Mr. Durbin. You have announced plans to select two Regional Centers. Have the two Centers been announced?

Dr. O'Connell. No. We released a Request For Proposals for regional centers in the Federal Register on December 23, 1992. Applications were due February 19. The ARRC Center received 14 appli-

cations. The Board initiated discussion of regional centers at its meeting March 2 and 3, 1993, but final decisions on where the first two regional centers will be located have not yet been made. We anticipate announcing the first two regional centers within the next four months. The Board envisions the regional centers as the grassroots "eyes and ears" of the AARC Center acting in many respects as a "circuit rider." We anticipate that the regional centers will consist of a director and one clerical person. The director will be responsible for getting proposals submitted, reviewing proposals, making recommendations to the AARC Center and Board, and monitoring progress. We expect the regional center directors to visit project sites at least on a quarterly basis to assure that progress is occurring according to predetermined milestones. If progress is not on schedule, it will be the responsibility of the regional center director to do everything possible to get the work back on schedule. Used in this manner, regional centers can be very productive and cost effective extensions of the AARC Center.

Mr. DURBIN. What proposals have you received from Regional Centers?

Dr. O'CONNELL. We have received 14 proposals for regional centers. Locations where the proposals originated include: Arizona, Arkansas, two from California, Georgia, Indiana, Iowa, Kansas, two from Louisiana, Minnesota, Mississippi, Oregon, and West Virginia.

Mr. DURBIN. What will be the estimated administrative costs paid from Federal funds for an individual Regional Center?

Dr. O'CONNELL. We expect the administrative costs paid from Federal funds for an individual center to be about $150,000 per year. This is based on the legislative requirement for matching funds, the Board's concept of regional centers as briefly described in an earlier question, and my personal experience in establishing regional centers for the Sustainable Agriculture Research and Education Program and the Aquaculture Program in the Cooperative State Research Service when I was Deputy Administrator.

Mr. DURBIN. And you are going to make site visits?

Dr. O'CONNELL. Yes. We received 14 proposals and we will have to see how these shape up around the country. But in areas where we had more than one proposal, we will go out and have them sit down and figure out themselves what would be the best location and put as much of the emphasis on the people out there in the region to determine the locations.

Mr. DURBIN. One of the things, as part of your charge, is to generate new jobs in rural areas.

Dr. O'CONNELL. Right.

Mr. DURBIN. And I think, as far as we are concerned, many of us on this Committee believe that this is critically important to your mission.

Dr. O'CONNELL. Yes.

Mr. DURBIN. So that we can see the development of products result in not only the profitability of crops but also the enhancement.

Dr. O'CONNELL. As we indicated in our plan here, one of the measurements of our success is we are not measured by government reports. We want to be measured by jobs and economic activity.

AARC BOARD OF DIRECTORS

Mr. DURBIN. In March 1992, the first Board was appointed by former Agriculture Secretary Edward Madigan. Would you please list for the record the members of the Board?

Dr. O'CONNELL. The AARC Center Board was appointed by Secretary Madigan on March 6, 1992. A list of the nine Board members, by category prescribed in the authorizing legislation, will be provided for the record.

[The information follows:]

MR. MARK DUNGAN

USDA representative. Office of the Secretary, Washington, DC (now vacant awaiting appointment by Secretary Espy).

DR. ROGER PORTER

Leading scientist. University of Massachusetts, Material Scientist, Amherst, Massachusetts.

MR. LEE REEVE

Producer and processor of agricultural materials. Reeve Cattle and Energy Company, Garden City, Kansas.

MR. PHILIP GROSS

Engaged in commercialization of starch polymers from agricultural materials. President of Novon Products, Morris Plains, New Jersey.

MR. JOHN FUJII

Engaged in commercialization of forestry products. Director of Manufacturing Technology, James River Corporation, Camas, Washington (retired in November 1992).

DR. RALPH HARDY

Nominated by the National Science Foundation. President of Boyce Thompson Institute, Ithaca, New York.

DR. JERRY CAULDER

Nominated by the National Science Foundation. President of Mycogen Corporation, San Diego, California.

MR. MARTIN ANDREAS

Nominated by the Department of Commerce. Senior Vice President, Archer Daniels Midland, Decatur, Illinois.

MR. DELWIN SCHNEIDER

Nominated by the Department of Commerce. President and CEO of CILCORP Ventures, Peoria, Illinois.

Mr. DURBIN. What is the duration of the appointment of individual members of the Board and to what extent does Secretary Espy have authority to appoint Board members?

Dr. O'CONNELL. Board members are appointed for four year terms, except that the legislation requires the initial Board shall be appointed to serve staggered terms. I will provide the terms for the record. The initial Board members were appointed for the following terms.

[The information follows:]

	Years
Mark Dungan	2
Roger Porter	3
Lee Reeve	4
Phil Gross	4
John Fujii	2
Ralph Hardy	4
Jerry Caulder	2
Martin Andreas	3
Del Schneider	3

Secretary Espy has the authority to appoint a member to the Board immediately to represent USDA, replacing Mark Dungan. In addition, Dr. Caulder's and Dr. Fujii's terms expire in March of 1994, at which time Secretary Espy will have the opportunity to appoint two more Board members.

PUBLIC HEARINGS

Mr. DURBIN. The Board held public hearings in the States of Iowa, Georgia, New Jersey, Oregon, California, Minnesota, Kansas, and Texas. What were the criteria used by the Board in selecting these States?

Dr. O'CONNELL. The Board did hold the eight public hearings you noted before deciding on policies and programs. Criteria used to select locations for the hearings included: geographic distribution, level of interest in the AARC Center, convenience for individuals in the region to get to the hearing, availability of acceptable facilities on the designated date, and willingness of individuals in the region to assist with the local arrangements. The Board received excellent grass roots input from well over 200 individuals representing small and large businesses, cooperatives, farmers, commodity groups, economic development agencies, state departments of agriculture and natural resources, and universities. These individuals expressed the need for functions authorized in the AARC Center legislation and ideas on how to operate the Center. This input was structured into the Strategic Plan, the Request For Proposals for both projects and regional centers, and long term plans.

WASHINGTON STAFF

Mr. DURBIN. Would you please list for the record the names of the staff of the Washington Center?

Dr. O'CONNELL. At this time, the Washington staff is the entire full-time staff of the AARC Center. The Board plans to continue to run the AARC Center with a very small staff. The Board appointed me to serve as Director. Dr. Joseph Roetheli serves as the Deputy Director. Ms. Patricia Dunn serves as administrative officer, and Ms. Joyce Alexander is our secretary.

Mr. DURBIN. To what extent are the salaries and expenses of the Washington staff paid from the appropriation of $7,500,000 for fiscal year 1993?

Dr. O'CONNELL. All salaries and expenses of the Washington staff and the Board must be paid from the appropriation of $7,250,000 for Fiscal Year 1993 or the carry over from Fiscal Year 1992, as these are the only current sources of funds. Section 1664 of the 1990 Farm Bill specifies how AARC funds should be used including funds for administrative expenses.

Mr. DURBIN. Are any USDA employees being detailed to the Board on a reimbursable basis?

Dr. O'CONNELL. Yes. My deputy, Dr. Roetheli, is detailed from the Cooperative State Research Service. Mrs. Beverly Gillot was on loan to the AARC Center from the Economic Research Service from August 1992 until March 1993. Ms. Dunn, our administrative officer, was detailed from CSRS since the inception of the AARC Center in March 1992 until February 14, 1993, when she officially was transferred to the AARC Center.

Mr. DURBIN. Are any USDA employees being detailed to the Board on a non-reimbursable basis?

Dr. O'CONNELL. No, the AARC Center and Board have no USDA employees detailed from other USDA agencies on a non-reimbursable basis.

Mr. DURBIN. Have you procured any temporary or intermittent services as authorized under 3109(b) of Title V, United States Code?

Dr. O'CONNELL. We have not procured any temporary or intermittent services as authorized under 5 U.S.C. 3109(b).

BOARD MEETINGS

Mr. DURBIN. The Board has been in existence for approximately 12 months now. Under the provisions of the law, the Board is required to meet at least three times. When and where have these Board Meetings been held and what members of the Board attended them?

Dr. O'CONNELL. The first meeting was held at the U.S. Department of Agriculture, 901 D St S.W. in Washington, DC, on April 13 and 14, 1992. All Board members attended. The first hearing was May 12, 1992, at the Sheraton Inn in Cedar Rapids, Iowa. Board members who attended were Martin Andreas, Mark Dungan, John Fujii, Delwin Schneider, and Lee Reeve. The second hearing was May 13, 1992, at the Sheraton Inn in Atlanta, Georgia. Board members who attended were Mark Dungan, John Fujii, Delwin Schenider, and Lee Reeve. The third hearing was May 14, 1992, at the Vista Hotel in Newark, New Jersey. All Board members attended except Martin Andreas and Jerry Caulder. The fourth hearing was May 27, 1992, at the Red Lion Inn in Portland, Oregon. Board members who attended were Mark Dungan, John Fujii, Delwin Schneider, and Philip Gross. The fifth hearing was May 28, 1992, at The Hyatt Regency in Sacramento, California. The Board members who attended were Mark Dungan, John Fujii, Delwin Schneider, and Philip Gross. The sixth hearing occurred June 16, 1992, at the Crown Sterling Suites in Bloomington, Minnesota. All Board members attended except Ralph Hardy and Jerry Caulder. The Board held the seventh hearing June 17, 1992, at the National Ag Center and Hall of Fame in Bonner Springs, Kansas. All Board members attended except Ralph Hardy, Jerry Caulder, and Roger Porter. The eighth hearing occurred on June 18, 1992, at the Hyatt Regency in Irving, Texas. All Board members were present except Martin Andreas and Jerry Caulder. Two special Board meetings were held in conjunction with the hearings—Cedar Rapids and Bloomington. The Board held a regular meeting on July 7 and 8, 1992, at the O'Hare Marriott Hotel in Chicago, Illinois. All Board members attended. The Board met for its third regular meeting on September

15–16, 1992, at the Denver Marriott in Denver, Colorado. All Board members attended. The Board met for the fourth time on December 13 through 15, 1992, at the O'Hare Hilton Hotel in Chicago, Illinois. All Board members attended. The Board met for the fifth time on March 2 and 3, 1993, at the Wyndham Hotel in San Diego, California. All Board members attended, except Roger Porter.

COMPENSATION OF BOARD MEMBERS

Mr. DURBIN. What was the total compensation of the Board during fiscal year 1992 and what is the estimate for fiscal year 1993?

Dr. O'CONNELL. The total compensation of the Board during Fiscal Year 1992 was $56,800. We estimate approximately $80,000 for Fiscal Year 1993.

Mr. DURBIN. Under provisions of the law, the compensation of the Board may not exceed the daily equivalent of the annual rate for grade GS–18 of the General Schedule. What is the daily rate the Board members will be compensated during fiscal year 1992 and fiscal year 1993?

Dr. O'CONNELL. Board members are being compensated at a rate of $415 per day.

OVERHEAD AND ADMINISTRATIVE COSTS

Mr. DURBIN. In considering proposals issued by the Center for Grants, Contracts, or Cooperative Agreements, you are supposed to take into account the project overhead and administrative costs. What types of criteria do you use in determining if overhead and administrative costs are reasonable on a given project?

Dr. O'CONNELL. The Board has decided that Cooperative Agreements, with clauses for reimbursing the AARC Center if the project succeeds, is the most appropriate legal instrument for making awards. Under Cooperative Agreements we will not pay overhead. If the AARC Center provides grants, we will require that overhead costs are reasonable and kept within OMB guidelines and comparable to guidelines used by the USDA-Cooperative State Research Service.

REVOLVING FUND

Mr. DURBIN. Has the revolving fund been established as an account at the Treasury Department?

Dr. O'CONNELL. Yes, the revolving fund has been established at the Treasury Department. Funds appropriated in fiscal year 1992 were transferred into the revolving fund account. The fiscal year 1993 appropriated funds were appropriated directly into the revolving fund.

Mr. DURBIN. How much has been deposited to date in the revolving fund, and what is the current balance?

Dr. O'CONNELL. The funds deposited are those appropriated to date; namely, the $4,500,000 in Fiscal Year 1992 and the $7,250,000 in Fiscal Year 1993. The current unobligated balance is $11,056,267.

Mr. DURBIN. Please list all funds drawn from the revolving fund to date.

Dr. O'CONNELL. To date $693,733 has been obligated for setting up a new office, office equipment, furniture, salaries and benefits, printing, travel and board salary. We anticipate that the bulk of the available funds will be committed to projects, currently under final review and negotiations, within the next few months.

REVENUES COLLECTED

Mr. DURBIN. You anticipate that you will collect revenues from successful projects which will then be deposited in the revolving fund for use on other projects. Please explain in greater detail how you will collect these revenues. In other words, will these be a share of the profits, or a licensing agreement, or some other mechanism?

Dr. O'CONNELL. The legislation authorizes the AARC Center to receive funds in return for sharing risk in getting a product or process to the marketplace. The Board feels strongly that successful projects should repay costs. The Board realizes some projects will fail despite everyone's best efforts because these projects are risky. If it weren't for this risk, AARC Center funding would not be needed. A repayment plan will be incorporated into the cooperative agreements as part of the negotiation process. The form of repayment will vary. For example, it would not be a wise business practice to make a start-up company repay as a loan in the first few years of operation—that would merely "pull the rug" out from their cash-flow and may cause the firm to fail financially. Thus, the Board will seek mutually beneficial arrangements such as fees, royalties, debentures, and preferred or common stock based upon specific circumstances.

UNCOMMITTED BALANCE

Mr. DURBIN. Of the approximately $12,000,000 appropriated for fiscal years 1992 and 1993, how much is currently uncommitted?

Dr. O'CONNELL. Currently uncommitted funds are $10,586,025. We anticipate that nearly all of the available funds will be invested in projects within a few months. The requests for assistance from the AARC Center totaled $175,000,000 in the preproposals, and the 48 applicants who the Board requested to submit full proposals were asking for about $30,000,000. Hence, even out of the full proposals, the Center has only about one dollar for every three requested in the full proposals. From the original 407 preproposals, the Center has only one dollar of funds for every $17.5 requested.

SUPERVISION

Mr. DURBIN. The Director of the Center is under the general supervision of the Board of Directors. This would appear to create the situation of a Federal employee being supervised by non-Federal employees. How does this relate to the General Provision of law that prohibits a Federal employee from being supervised by non-Federal employees?

Dr. O'CONNELL. The relationship between the Board of Directors and the Director is one established by statute, so this relationship is authorized by law. In any event, the official ultimately responsible for the AARC Center is the Secretary of Agriculture, who obvi-

ously is a Federal employee. The Secretary appoints the Board and can veto their actions. The USDA Office of the General Counsel reviewed this issue before the Board met for the first time last April. They determined that when the Board is acting in its official capacity as AARC Center Board members, they are, in fact, Special Government employees. Board members who are not Federal employees are authorized to receive compensation for performance of official Board duties and responsibilities.

Mr. DURBIN. Mr. Skeen?

COST SHARING ON PROJECTS

Mr. SKEEN. Thank you, Mr. Chairman.

It has been a very interesting discourse. And I would like to know—let's go back to the cost-sharing. I know it varies from project to project.

How do you determine the percentage of cost-sharing?

Dr. O'CONNELL. In general, we will want to have these projects where the private sector partner is 50 percent or more.

Mr. SKEEN. You never go over 50 percent?

Dr. O'CONNELL. We may, on certain situations. But in general, it would be 50 percent or more.

Mr. SKEEN. Somebody has to make that determination. Is it a group that makes it?

Dr. O'CONNELL. Yes. The AARC board.

Dr. HARDY. To date, the Board has looked at the preproposals and initially selected 40 who then developed full proposals. The Board has now gone through those 40 and selected 10 to 20 that we are going to look at for funding. There will be a Board member that will accompany the staff to every one of those that we are considering for funding, where there is substantive funding involved. So the Board is very involved in these early rounds and getting this set up. We have a venture capitalist on the Board, we have two of us at least who have been involved in starting new biotech companies and so on. There is a lot of experience base there in how you do these sorts of relationships.

Dr. O'CONNELL. Two venture capitalists are on the Board so there really is experience on the Board for this.

Mr. SKEEN. That indicates to me that there is a great deal of negotiation.

Dr. O'CONNELL. Absolutely. Dr. Hardy was mentioning that we plan to negotiate what the cost sharing is going to be. In general, it was like 2.5-to-one shared cost when they sent in the proposals originally.

Mr. SKEEN. One being the government share and the other the private share?

Mr. O'CONNELL. Right. That was the average.

Mr. SKEEN. Across the board?

Mr. O'CONNELL. Yes.

Mr. SKEEN. But the returns are negotiable?

Dr. O'CONNELL. Yes. How we will determine the returns, in some cases——

Mr. SKEEN. Are they done on the same basis in which the input is made?

Dr. HARDY. Returns I think have to vary with the situation. In some ways——

Mr. SKEEN. Is this a negotiable item?

Dr. HARDY. Right. In some cases we will consider equity. In other cases we will look at the return cost plus the interest on the investment, and there is going to be a whole distribution probably in between those two extremes.

Mr. SKEEN. You indicate you have something like 407 proposals.

Dr. O'CONNELL. Correct.

Mr. SKEEN. What would be the government's share if all the projects that deserved funding were funded?

Dr. O'CONNELL. As I indicated before, what that averaged out to and that is before negotiation, which could have changed.

Mr. SKEEN. 2.5-to-one?

Dr. O'CONNELL. 2.5-to-one.

Mr. HARDY. There is about $430 million sought totally for those, and a third of that roughly was being sought—$175 million was sought from AARC.

Mr. SKEEN. That would have been total if you had——

Dr. O'CONNELL. Yes, but from AARC, they were asking for $175 million.

Mr. SKEEN. Did you put it in a contract form, the proprietary arrangements and so forth, that some of this is new ground or new inventions? Did you cover that in your contracts?

Dr. O'CONNELL. Yes. We say right up-front that there is intellectual property rights that they have to begin with, and they can keep those. As a result of the projects that we jointly fund, we would negotiate the royalties and that sort of thing. If they bring to the table patents, they can protect them. We have no problem with that. If it is something as a result of joint funding, under those circumstances, then we may negotiate some kind of royalty arrangement.

REGIONAL CENTERS

Mr. SKEEN. In locating these centers, you are taking into account the very poor and the more rural communities? That is part of the element of your discovery and decision-making?

Dr. O'CONNELL. Yes. What we see with the regional centers and one of the key areas out there doing similar work in almost every State are economic development corporations, and they are doing a similar kind of effort that we are. Joining up with private companies to try to get economic activity underway. We have about three or four applications along that line, but we see a real marriage of common interests.

Another important aspect of this is that many of these current economic development centers aren't looking at agriculture as a legitimate investment. That is true in States like Illinois and in Iowa and so forth, and so we feel that if we would jointly be with them at their location, we could encourage them to look at agriculture in a more promising way.

Mr. SKEEN. Well, I think you touched on a real point of nerve in response to this thing, because agriculture has not been the most attractive investment opportunity.

Dr. O'CONNELL. That is right. But we see here things that are attractive. People just don't know about it yet.

Mr. SKEEN. What you are getting at here is the probability of making it more attractive?

Dr. O'CONNELL. That is correct.

Mr. SKEEN. I applaud you in that effort. I have a lot of reservations about how you are going to make this thing work.

Dr. O'CONNELL. Well, even on these products right here, compared to the fundamental economics of this, you got 10, 11 cents of starch here, whereas in polyethylene you have 40. Now, the initial company that is putting that out there is going to try to attract the market and they are going to charge, but the fundamental economics of this right here is better than polyethylene.

In fact, the raw material cost is one-fourth the cost, and it gets back to the point that Dr. Hardy was making that with our ability to convert these things now, renewable materials that are environmentally safe will stand some real good economics, we think.

Dr. HARDY. Yes. AARC should not be a subsidization activity. AARC should be a pure business, and AARC should become self-sustaining.

Dr. O'CONNELL. Yes.

Dr. HARDY. In time.

Mr. SKEEN. I mentioned to the Chairman here just a little while ago about a university in New Mexico which is researching the tobacco patch and encouraging people not to smoke. It is returning a huge investment advantage back to the university which was cooperating with one of the laboratories. This kind of basic research and merchandizing can help, particularly in the area of agriculture.

Dr. O'CONNELL. That is what the AARC Center is. We see us as a catalyst. We expect to get a return if it is successful.

Mr. SKEEN. Well, good. We want the government to start making a little money, because we have some folks that want to spend a lot of it. Thank you very much for your testimony, and thank you.

Mr. DURBIN. Ms. Kaptur, a member of this subcommittee has questions that she would like answered for the record.

RURAL DEVELOPMENT

Ms. KAPTUR. In last year's report, the Committee requested that the AARC Center "give significant attention to new crops, new uses, or new products that provide new on-farm or local community enterprises in rural areas" and "increased attention to new uses or new products from resource-conserving crops." I am very interested in how the AARC Center is meeting those goals.

How have the evaluation criteria in the authorization of the AARC Center "likely positive impact on resource conservation and the environment" and "likely positive effect on helping family-sized farms and rural communities near affected agricultural or forested areas" been defined in program materials and requests for proposals? What instructions are provided to proposal reviewers to ensure that these goals are advanced?

RESPONSE. The request for pre-proposals specifically states, "The AARC Board seeks projects that will have market impact on new and existing agricultural products and will favor projects with: * * * positive impact on resource conservation and the environment * * * positive effect of helping family-sized farmers and rural communities near the affected agricultural and forested areas." Furthermore, the preproposal reviewers were selected with these factors in mind.

In addition, the AARC Center provided pre-proposal reviewers specific guidance in the evaluation. The evaluation form provided to reviewers of the pre-proposals con-

sisted of 5 basic components—one of which addressed potential impacts listing: "job creation; rural economic activities; market size and trends for product/process; crop utilization potential—acres, volume; environmental benefits; resource conservation effects; and reduced federal crop subsidies or other assistance programs." Each reviewer was asked to comment on the strengths and weaknesses of the pre-proposal in these specific areas. In selecting preproposals for phase II, the Board gave significant weight to the impacts on rural development, resource conservation, the environment, and bio-diversity.

In the full proposals, the AARC Center provided a form on which the applicant supplied information. Only 3 topic questions posed had a full page provided for responses with some description of type information being sought. The three topics were: (1) product and process involved, (2) environmental impacts, and (3) resource conservation effects. The Board continually referred to the environmental and economic impacts as they made their decisions on full proposals, since key performance measurement criteria in the AARC Center Strategic Plan relate to number of direct jobs created—rural and total—and number of products that enhance the environment. Forty percent of all full proposals, including those related to forestry and animal byproducts, involved new crops.

Ms. Kaptur. What additional action or actions have been taken to identify and prioritize projects to achieve this Committee's goal of increased attention to on-farm and local community enterprises and resource-conserving crops? Are these priorities communicated clearly in the request for proposals?

Response. The request for pre-proposals included the following language in the section on evaluation criteria, "The likely effect on helping family-sized farmers and rural communities near the affected agricultural and forestry areas." Lee Reeve, the Board member representing producers and an on-farm processor himself, has been a very outspoken champion on this subject. This concern resulted in the Board selecting two very promising projects for possible funding that would use lignocellulosic materials—portions of crop residues, soil conserving forage crops, or low value forest materials—to produce marketable chemicals. The low bulk density of these materials necessitates on-farm or local processing.

Ms. Kaptur. Of the pre-proposals that have been selected for "phase two" consideration, what percentage utilize primarily resource-conserving crops? What percentage involve on-farm processing? What percentage locate the processing in the local, rural community where the crops are grown?

Response. For all phase II proposals, 64 percent involve resource-conserving crops and 78 percent would locate processing facilities in the rural community where the crops are grown.

For the 22 top proposals selected for possible funding—from the 48 phase II proposals—73 percent involve resource—conserving crops and a similar percentage would locate processing facilities in the rural community where the crops are grown.

Approximately 9 percent of the 48 phase II proposals as well as the 22 top proposals involve on-farm processing.

Mr. Durbin. Mr. Peterson?

AARC CENTER

Mr. Peterson. Mr. Hardy, with all due respect, I have to admit I have some suspicion with the AARC, and I am surprised, frankly, that it was included in the 1990 bill. My concern involves the starting of a new program from scratch without trying to merge these things into all of the other activities that are going on in USDA.

But I will keep an open mind and assume that you are going to return with some real success stories. I don't know quite how you are going to do that. You are going to give loans, and then, as I understand it, you are going to get those loans paid back, but you are not going to enjoy the benefits of the profits. Is that true or false?

Dr. Hardy. That is not quite true. I think the relationships we have will go from loans and return as a minimum to equity holdings at the other end. With a very successful activity, AARC could be the holder of equity in that, and you know, IPO and so on, could

sell its equity and return that into the AARC area. In between those extremes we may end up with a percent of royalty on products and processes that could come out of what we are doing.

Mr. PETERSON. Is, in fact, that part of your mission, to write the contracts and to, in fact, make sure that the government has adequate return for anything that you would get into?

Dr. HARDY. The nature of the people that are on this Board are business people, and clearly, it is our intent, first of all, that there be a 50 percent or more contribution, in almost all cases, coming from the private sector. And secondly, that we participate in the successes. We are going to have failures. In the type of business that we are in, we are going to identify some opportunities that aren't going to be successes, as any business has. And one would expect we will have some opportunities that will be marvelous successes, and we want to make sure we participate in those that are large successes, so that in time, AARC can become a self-sustaining activity.

Mr. PETERSON. Have you any time line on that? Is there any dream sheet?

Dr. HARDY. I think it is premature at this time to suggest that. We are taking agriculture, which has been mentioned as an area where there has not been a lot of investment in terms of doing what we are talking about, and beginning to do that, to do it successfully and attract attention to it. It may well become that if we are successful enough, the private sector will become so interested in this area that somewhere down the road an AARC will not be needed, in fact.

COMPOSITION OF AARC BOARD

Mr. PETERSON. Well, it just seems to me that there is some duplication. Also, looking at the Board makeup, I hope some of the directors have visited Disney World, because that is the only relationship with the Mason-Dixon Line I can see on the residency. In fact, the regional centers, I would predict, are going to be in Illinois, and in the New England States.

Dr. O'CONNELL. There will be one down south.

Mr. PETERSON. Ultimately, but the first two clearly are not going to be in the south.

Dr. HARDY. The Board initially looked at the proposals a week ago. We have had some discussions on where those first two centers might be located. We are sensitive to the issue that you have just raised and we were sensitive in our discussions.

Mr. PETERSON. There is clearly not a good geographic makeup on that board, and I would submit that we have some pretty good businessmen and women there in the south, in the southeast and southwest.

Dr. O'CONNELL. You need to understand that the Board is set up so that members are appointed to staggered two and three and four-year terms. In March of next year, the first two or three members will be replaced so there will be an opportunity for new members.

Mr. PETERSON. Again, I must admit, I am a little suspicious, but I will keep an open mind.

COORDINATION OF EFFORT

Dr. O'CONNELL. We are working with the research pretty well after it is done. We will be working very closely, in fact, on almost every one of these projects. There will be scientists most likely from an ARS lab or university lab. But what we are doing beyond what is done now is to develop joint projects to take care of this pre-commercialization work that is not being done. So many of these ideas are just sitting there and not being taken along far enough where they are actually putting products on the marketplace. That is the fundamental problem.

That is what we are trying—we are not replacing what anybody else is doing. In fact, almost every one of these projects came from either government labs or university labs or in some cases industry labs, so we are not repeating that. There may be some research we have to do again that in cooperation with these institutions, but what we are doing is working with private companies to bring these products to market, and that hasn't been happening at the rate it needs to happen to help agriculture have more diversity in markets. So it really isn't, as I see it, repeating what other agencies are doing.

Mr. PETERSON. Well, I applaud that. I want that to happen. I am just maybe suggesting that some of the other agencies who may have had that mission just weren't doing it. I am not saying that I know that; I am just making some assumptions.

Dr. O'CONNELL. We can actually enter into agreements and put money, and the other agencies couldn't do that. By law they couldn't do that.

Mr. PETERSON. All right. Thank you, Mr. Chairman.

Mr. DURBIN. Thank you very much, Mr. Peterson. Let me clarify that, Dr. O'Connell. You have worked in USDA before.

Dr. O'CONNELL. Oh, yes, for quite a while.

JOINT AGREEMENTS

Mr. DURBIN. Can you point to any other agency within the USDA that does any part of what you are presently tasked to do?

Dr. O'CONNELL. Well, yes. Previously I was with the Cooperative State Research Service and we had the Office of Agriculture Materials. We did enter into some agreements with companies based on section 1472(D), of the Farm Bill. We actually entered into joint arrangements with private companies.

But these were primarily programs that were put in by Congress. They weren't a competitive program like we have here. In other words, this is a competitive program where we go out and look for projects—We had 407 submitted this year. We had to select about 15 or 20 in our initial funding, so we hope we are looking at the most promising projects out there.

So from that that standpoint, they weren't competitive before, but CSRS had some of this, and, of course, you have them within ARS, who have CRADAs that they work on. And from the technology that came out of their labs ARS will work with private companies to develop that technology, and they will keep that private.

But there is no money from the Federal side for these activities such as regulatory concerns or testing or setting up a prototype.

We jointly go in with a private company and actually try to develop those. The CRADAs do not change any money. They are purely trying to keep the technology and science private for that particular company, but the actual sharing of development costs they don't do. We do. As I indicated before, that is where the cost is. For every dollar of research that you have to bring to the marketplace, it takes $10 to develop it and another $100 to get it to the market—that is where we are helping.

ROLE OF AARC

Mr. DURBIN. I am going to give you an example and I want you to differentiate your mission from what we were told yesterday. ARS developed the technology to dehydrate potatoes to make a product such as Potato Buds, which became a commercial venture by some major company. Once necessity had developed this technology, it is my understanding that through a CRADA they licensed that technology to the company and they were repaid as that company put the product on the market.

Dr. O'CONNELL. They were receiving royalties back for that.

Mr. DURBIN. All right. Now, please tell me the difference in what you are setting out to do in contrast to what I have just described.

Dr. O'CONNELL. Okay. Let me come back to my testimony so I can get more specific about it.

In that particular case, that technology went to the market place without any help on the development costs. That did occur. What we are saying is, there is a lot of opportunities out there with these new uses, and in that particular case they did not share costs for, say, designing equipment, for testing products for performance, or obtaining regulatory clearance.

That money came from the private sector totally and completely. When they put that product on the market, they licensed the technology and then the ARS lab would get back the royalty. But in that example, they did not share costs of developing that product.

That product was evidently attractive enough where they didn't have to do it. The private companies saw that they could make money in a short enough period of time, they did it on their own. Our point is that there are alot of other products like we are talking about out there; it is not happening. In that case, it did.

And in our case, we have some proposals then where there are CRADAs and situations set up where likely we are going to be funding, and so we are going to take it to the next step. Sharing development costs with the private company. CRADAs don't do that.

Dr. HARDY. Can I add a comment to that? The chain of agricultural research to food and to feed is a very well established one. The example that you have given is in that established route. I think it is easier to provide that early science, that patent and so on and have it taken up and developed in the food and feed area than it is in the industrial use area.

AARC will not be involved in the food and feed area. We are looking at the industrial use area. There the catcher's glove isn't as well developed to do those things as in the food and feed area.

Mr. DURBIN. I don't want to dwell on this, but I want to make sure I understand the difference. ARS yesterday came up with a discovery in a Peoria lab, a corn-based product called Super Slurper that is an absorbent product used in diapers, and fuel and air filters on automobiles and the like. That is clearly a non-food application.

You are saying that you would engage someone from the private sector in the development portion of that.

Dr. O'CONNELL. If it is needed. In that case, it wasn't needed. As indicated in our legislation we should not enter into a joint project with somebody if it is going to happen in the private sector.

One of the key questions we asked a lot of people when their proposals came forth was would it happen without our support. In the case of Super Slurper, it happened without government support for development costs. That is fine. We want to make sure that continues.

We are only entering into those situations where it is not likely to happen without some joint development costs. In that case, it did.

Mr. DURBIN. Thank you very much. I appreciate your testimony today. We will be working with you.

STATEMENT OF
RALPH W. F. HARDY
MEMBER OF THE BOARD OF DIRECTORS
ALTERNATIVE AGRICULTURAL RESEARCH &
COMMERCIALIZATION (AARC)
CENTER

BEFORE THE SUBCOMMITTEE ON
AGRICULTURE, RURAL DEVELOPMENT, FOOD AND DRUG ADMINISTRATION
AND RELATED AGENCIES

March 11, 1993

Mr. Chairman and members of the Subcommittee: On behalf of the AARC Board, I want to thank you for the opportunity to discuss the ongoing activities of the Board and the AARC Center.

From the beginning, I have been impressed with the unique characteristics of the AARC Center and its mission. I don't know many, if any, government agencies that have one federal member and eight non-federal representatives of commercial, financial, producer and scientific interests setting program directions. I believe that AARC can be a powerful and effective tool in accelerating the identification and development of new commercially-viable products made from crop, animal and forestry materials.

Mr. Chairman, the AARC Board concurs with a recent report issued by the National Academy of Sciences. The report, entitled The Government Role in Civilian Technology, found that private

industry is better suited than public institutions to determine market winners. The report points out that cost-sharing is one of the most effective ways to ensure that a project will achieve market success. We agree. While the level of cost-sharing may vary from project to project, the board will give great weight to the level of private financial resources involved in determining which projects to support. For example in the 407 pre-proposals received by the Center recently, the total project budgets summed to $448 million with $175 million requested from the AARC Center -- that's more than $2.50 contributed by others for every $1 requested from the Center.

The AARC concept is right for the times. With increasing international competition in the marketplace, public-private cooperation and partnerships are critical to the quick and effective movement of new technology from government, university and institute laboratories to the marketplace. I firmly believe that **the central operating principle of AARC must be cooperation with the private sector.** In essence, AARC is a service organization dedicated to assisting private industry accelerate the development of economically-viable, new, agriculturally-based products and materials that expand markets for agriculture while spurring rural development including the creation of jobs.

<u>Background</u>

The 1990 Food, Agriculture, Conservation and Trade Act authorized the Center and in March 1992 the first Board was appointed by former Agriculture Secretary Edward Madigan. The Board convened its first meeting in April 1992 and elected Martin Andreas of Archer Daniels Midland as chair. Mr. Andreas couldn't be here today, so I am filling in for him. At the initial meeting, the Board also asked Dr. Paul F. O'Connell to serve as Acting Director. The Board has since made Dr. O'Connell's appointment permanent.

The Board's first order of business was to schedule eight public hearings to obtain input before we contemplated policy and program decisions. These were held in Iowa, Georgia, New Jersey, Oregon, California, Minnesota, Kansas, and Texas. The Board heard from more than 200 individuals and organizations. We heard from Commissioners of Agriculture, processors, manufacturers, farmers, entrepreneurs, farm organizations, commodity groups, cooperatives, foundations, universities, and state legislators.

The Board was impressed and encouraged by the enthusiasm of witnesses for the AARC Center approach. We were urged by many witnesses to take a leadership role, to make it happen, to help turn ideas into marketplace successes. The AARC Center has since adopted the motto, "Make It Happen," and we fully intend to do exactly that with your continued support. We heard from witnesses that many rural economies need an economic "shot in the

arm" and that new, industrial, non-food, and non-feed uses of agricultural materials can help provide that medicine. We heard repeatedly that the AARC Center should be a catalyst, a coordinator, and a facilitator for finding new industrial uses for traditional and new crops, animal byproducts, and forestry materials. Some witnesses told the Board that more fundamental research is needed to support new product development and we believe that to be true. However, the majority of the witnesses identified pre-commercial demonstration and testing activities as the most critical area for the AARC Center's focus.

Themes that were replayed throughout the hearings included:

* Operate like a business;
* Maintain independence and avoid bureaucratic thinking;
* Keep the application process simple and minimize red tape;
* Leverage your resources; and
* See yourself as an economic development organization.

Strategic Plan

To guide our actions, we prepared a strategic plan. The mission of the AARC Center is to accelerate the commercialization of industrial products from farm and forestry materials -- creating jobs and economic activity. A copy of the plan has been provided for you, and I will highlight some key points.

Some fundamental beliefs:

- The U.S. has abundant natural resources to meet food, fiber, and industrial demands;

- A gap exists between research advances and private sector ability to assume risks involved in commercializing new products/processes;

- Private sector direction and active participation are needed for successful product development.

- New technological and scientific tools such as genetic engineering, new fermentation approaches, and chemical catalytic processes have opened non-traditional markets for farm and forestry products.

The key functions of the AARC Center are:

1. Be a Catalyst, Facilitator and Coordinator.
   - Enhance cooperation to build partnerships between and among appropriate state and federal agencies, universities and private companies that accelerate commercialization and long-term viability of bio-based ventures.
2. Form Private/Public Partnerships.
   - For pre-commercial projects, encourage private-sector sponsorship with the AARC Center generally providing less than 50 percent of total funds.

3. Project Funding.

   - Develop a portfolio of long-/short-term projects with an initial mix providing significant sales within three to five years.

   - Collect revenues from successful projects and reinvest these funds in other projects.

4. Information Exchange.

   - Facilitate the collection and dissemination of information concerning AARC Center projects and provide this information to others building data and information bases for industrial products from agricultural and forestry materials.

Responsibilities are described for the board, staff, regional centers and the private sector. One of the key points of the plan is the manner in which success will be measured. Performance indicators are not the number of government reports, but such items as number of products penetrating the market; number of rural jobs; quantity of agricultural and forestry materials used; and how the products/processes enhance the environment.

Current Activities

On August 17, 1992, the Federal Register listed the first request for pre-proposals. The 407 pre-proposals requesting $175 million in assistance were received before the October 31, 1992,

deadline. Approximately $10 million appropriated in 1992 and 1993 is currently available to fund these projects.

In November, pre-proposals went through a comprehensive review process in line with the enabling legislation and guidelines from the Board. Three outside specialists, including at least one with business experience and another with technical knowledge, plus the AARC Center staff reviewed each pre-proposal. After considering reviewers' comments and using their own judgement, AARC Board members met in December and selected 48 for further consideration. Oral presentations were held for biodiesel and lignocellulose conversion proposals because of their similarity and number -- to assure selection of the most promising ones for full proposal submission. Full proposals from successful pre-proposal applicants were submitted in February 1993. Announcements of successful projects are expected in late March.

Proposed projects range from small start-up operations to large-impact technologies. Raw materials include starches/carbohydrates, fats and oils, fibers, forest materials and animal byproducts. Here are some examples:

- using waste paper and soybean proteins to produce a composite building material with the appearance of polished granite;

- biodegradable oil for operating equipment in a marine or forest environment as well as for use in gear oils, metal cutting oils, and transmission fluids;

- developing a windshield washer fluid from renewable ethanol;

- starch-based polymers (from corn, wheat and potatoes) for non-recyclable, disposable plastic items such as food packaging, personal care items and medical products;

- fuel ethanol from cellulosic material in straw, corn hulls and grasses.

In general, AARC resources will provide less than 50 percent of the R&D funds required to bring a new product or process to the market. The intent is for the private partner to decide which new use will survive in the competitive business world -- and that can best be determined by requiring successful applicants to provide a major share of start-up costs.

We have also sent out a request for proposals on Regional Centers. Dr. O'Connell will discuss that in his testimony.

<u>Conclusion</u>

While ideas for new industrial uses have been around since the 1930s, there has been no consistent effort to make them commercially viable. When surpluses were high, a big push occurred. When supply was more in line with demand, interest waned. Now, consistent commitment is becoming more evident. For example, in 1992, non-traditional uses (such as sweeteners, ethyl alcohol, and industrial starch) of corn equaled corn exports. By the year 2000, industrial uses are expected to consume an estimated 2.4 billion bushels of corn -- a billion bushel increase!

More than 70,000 acres of industrial crambe and rapeseed are now grown annually for lubricants, plastics and anti-foam agents. Crambe production has grown from a demonstration with 2,200 acres in 1990 to approximately 60,000 acres this year. In 10 years, expect to see 300,000 acres of those crops. Biodiesel, degradable starch polymers, adhesives, inks, paints and paper products from agricultural materials provide other promising growth areas.

As new markets develop, farmers and rural America will become far less dependent on federal farm program payments -- thus reducing federal outlays. Better demand for product will more fully utilize our agricultural capacity and infrastructure. We will see rural economies improve -- and the nation's economy as a whole -- will benefit.

This completes my testimony Mr. Chairman. I will be glad to respond to questions during the discussion.

ALTERNATIVE AGRICULTURAL RESEARCH AND COMMERCIALIZATION

AARC CENTER

STRATEGIC PLAN: "A LIVING DOCUMENT"

Empowering Authority
The Food, Agriculture, Trade, & Conservation Act of 1990
(P.L. 101-624, Title XVI, Subtitle G)

Preliminary publication for the 1993 USDA Outlook Conference

VISION

What does the AARC Board want to create?

- The world's most effective organization in generating new industrial(non-food, non-feed) market demand for U.S. farm and forestry products.

MISSION STATEMENT

What is the purpose?

- To generate widespread interest and profitable investment in developing and commercializing new industrial and consumer products that use farm and forestry materials, with preference for projects that benefit rural communities and are environmentally friendly.

BELIEFS & VALUES

What guiding philosophies determine the AARC Center's unique approach?

- Agriculture can be an engine of economic growth and opportunity for the 21st century.

- The U.S. has abundant renewable natural resources to meet both food and industrial demands.

- Increasing global competition in agricultural commodities dictates the need for private/public partnerships in developing value-added products.

- A gap exists between research advances and private-sector ability to assume the risks involved in commercializing new products/processes.

- For sound economic as well as environmental reasons, concerns about the use of non-renewable resources are focusing new attention on the development of renewable resources.

- Private-sector direction and active participation are needed for successful product development.
- New opportunities exist for manufacturing products from agricultural and forestry materials.
- New technological and scientific tools such as genetic engineering, new fermentation approaches, and chemical catalytic processes have opened non-traditional markets for farm and forestry products.
- Human and environmental health both will benefit significantly from developing and marketing renewable "bio-based" industrial products.
- AARC-sponsored ventures will benefit rural America by creating new markets and jobs.

GOALS

Specifically, what is the AARC Center designed to accomplish?

- To more rapidly develop and commercialize new industrial and consumer products made from agricultural and forestry materials, providing new products for consumers and new markets for farmers.
- To penetrate markets with products/co-products and processes by providing financial assistance to demonstrate or leverage promising opportunities that enhance marketability and economic viability of industrial products from agricultural and forestry materials in global markets.
- To bridge development and marketing efforts among manufacturers, private and government laboratories, universities, and financiers — thus closing the gap between research results and marketable, competitive products and processes.
- To facilitate and broker exchange of information about projects that use agricultural and forestry materials in industrial products.
- To impact economic development in rural areas and create new jobs.

FUNCTIONS

How will the AARC system operate?

I. CATALYST/FACILITATOR/COORDINATOR

1. Enhance cooperation to build partnerships between and among appropriate state and federal agencies, universities and private companies that accelerate commercialization and long-term viability of bio-based ventures.

2. Expand market opportunities for U.S. farmers through development of value-added industrial products such as degradable bio-based polymers (plastic substitutes), fibers, bio-fuels, inks, lubricants, paints and coatings.

3. Build and reward teamwork.

4. Maintain environmental awareness.

II. PRIVATE/PUBLIC PARTNERSHIPS

1. For pre-commercial projects, encourage private-sector sponsorship with the AARC Center generally providing less than 50 percent of total funds.

2. Require a higher percentage of funding from the private sector as the product/process approaches commercial viability.

III. PROJECT FUNDING

1. Accept proposals on a continuous basis with funding decisions at least three times per year.

2. Develop a portfolio of long/short-term projects with an initial mix providing significant sales within three to five years.

3. Select projects after competitive business and technical review.

4. Focus funds on:
   a. Pre-commercial products and processes with identified markets;
   b. Commercialization assistance.

5. Encourage research organizations to pursue work that results in a continuous and ample flow of high-quality, high-value proposals for the AARC Center to fund in the development and commercialization phases.

6. Collect revenues from successful projects and reinvest these funds in other projects.

7. Fund a range of projects, including emerging growth and large-impact projects.

8. Assure availability of funding for worthy projects.

IV. INFORMATION EXCHANGE

1. Facilitate the collection and dissemination of information concerning AARC Center projects and provide this information to others building data bases for industrial products from agricultural and forestry materials.

2. Facilitate a national network through the regional centers to provide expert input for identification and selection of AARC Center projects, to minimize duplication of effort and to effectively pursue objectives.

3. For the AARC Center, develop and distribute technical documents, promotional materials and annual reports.

4. Information submitted in proposals, pre-proposals, or covered under an agreement with the AARC Center will be treated as confidential. The intellectual property rights belong to the proposing organization, unless specifically negotiated otherwise.

   a. The legislation [Section 1662 (d)] protects the proposal and work under an agreement from the Freedom of Information Act.

   b. Reviewers of proposals are under penalty of law to keep contents confidential. That condition is clearly communicated to reviewers.

   c. The AARC Center staff will screen proposals and make every effort to ensure that no AARC Center Board member has access to the intellectual property contained in proposals from competitors of his or her company or organization.

   d. The legislation [Section 1659 (i)] requires Board Members to exclude themselves from voting on proposals where a conflict of interest might exist, such as where there is a financial or employment interest.

V. Responsibilities Of:

BOARD	STAFF
• Champion cause of new uses	• Implement policies and procedures
• Provide leadership	• Manage day-to-day affairs
• Set direction and priorities	• Obtain and manage staff
• Establish policy	• Draft policy options
• Select projects to fund	• Recommend projects for funding
• Determine form of assistance	• Establish peer reviews and implement agreements
• Establish regional adminstrative centers	• Arrange for payback on successful projects
• Educate the public	• Supervise regional centers
• Be responsive to public feedback	• Prepare technical, promotional and press reports
• Elect board chairperson	• Administer revolving fund
• Supervise AARC Center Director	• Establish networks
• Appoint committees	• Coordinate plans and studies
• Implement controls	• Assure accountability including project report
• Meet at least three times yearly	• Identify hindrances and ways to overcome them
• Present information to Congress and to the Secretary of Agriculture	• Provide information to Congress and all interested parties

REGIONAL CENTERS

- Identify product champions
- Identify regional needs and opportunities
- Accept proposals and assist with peer reviews
- Recommend projects for funding
- Suggest policy options
- Accept proposals and assist Staff in preparation and processing of RFPs
- Monitor project progress and provide technical assistance
- Advise the AARC Center and Board
- Develop and disseminate information
- Coordinate with regional entities including SBDCs
- Make contact with potential cooperators
- Develop grass-roots support
- Establish network of project brokers
- Develop and disseminate information

PRIVATE SECTORS

- Act as product champions
- Invest in developing alternative uses
- Provide leadership, including serving on AARC Boar and committees
- Serve as the lead organization in commercialization projects
- Initiate new ventures
- Provide expertise
- Demonstrate feasibility and profitability of new products and processes
- Share in new-venture financing
- Disseminate general information about successes
- Work closely with AARC Board, staff, and regional centers
- Identify market signals
- Subcontract with university experts when appropriate
- Provide feedback for improvement of AARC Center operations
- Recruit new product champions
- Take measured risks in trying new raw materials and products

Making it Happen

OBJECTIVE TO ACCOMPLISH

In cooperation with the private sector, commercialize industrial and consumer (nonfood, non-feed) products from U.S. grown renewable materials that create jobs, enhance rural economic development and diversify markets.

Performance Measurements

Key Indicators	Time Frame: Two Years	Time Frame: Five Years	Time Frame: Ten Years
Number of products penetrating markets			
Number of direct jobs created			
Rural			
Total			
Sale of Products ($)			
Number of acres or volume of material used			
Substitute domestic production for imports			
Number of crops/products			
Percent substitution			
Related Indicators			
Number of partnerships formed			
Private/public			
Private/private			
Annual revenues created			
Proposals brokered with other entities for funding			
Number of products that enhance the environment			

WAYS AND MEANS

How will the AARC Center accomplish its mission and objectives?

1. Upon release of request for proposals (RFP), advertise widely, especially in media read by the private sector, to get the best possible projects.

2. Apply sound business and technical principles in evaluating proposals.

3. Conduct thorough due diligence to assure that applicants can accomplish their goals and objectives both from a business and a technical perspective.

4. Select projects to meet AARC Center objectives.

5. Provide technical assistance to projects that encounter obstacles.

6. Broker with other organizations to fund quality proposals that the AARC Center is unable to fund.

7. Sponsor workshops and meetings in cooperation with the private sector.

8. Inform administrative and congressional policy makers about the payoffs from AARC sponsored projects.

9. Decentralize staff to provide a regional presence that is proactive in seeking new opportunities and partnerships.

10. Encourage research organizations to fund work that will lead to new opportunities for the AARC Center to fund in later phases.

11. Develop an information network that includes projects and individuals and nurture these relationships.

12. Have board and staff members meet with promising private-sector partners.

13. Work closely with research organizations to implement a reward system for scientists who do applied work with private firms — leading to a commercial product.

14. Empower and reward regional center staff for attracting private firms to submit quality proposals.

15. Work with EPA and environmental groups — as well as with USDA — to establish a "seal of approval" (and criteria) for environmentally friendly products.

16. Implement mechanisms to gather grass-roots ideas on how to improve the AARC Center, program.

17. Be responsive to recommendations from periodically scheduled appraisals from clients and customers.

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STATEMENT OF
PAUL F. O'CONNELL
DIRECTOR
ALTERNATIVE AGRICULTURAL RESEARCH
& COMMERCIALIZATION
(AARC) CENTER

BEFORE THE SUBCOMMITTEE ON
AGRICULTURE, RURAL DEVELOPMENT, FOOD AND DRUG ADMINISTRATION,
AND RELATED AGENCIES

March 11, 1993

Mr. Chairman and members of the Committee: As Director of the AARC Center, I value the opportunity to discuss activity underway in USDA's Alternative Agricultural Research and Commercialization (AARC) Center. I envision considerable potential to expand the commercial use of agricultural materials (traditional and new crops, animal byproducts, and forestry materials) in industrial products.

In testifying today I want to emphasize at the outset that the Administration is currently formulating the President's FY 1994 Budget. Accordingly, I am not in a position to provide you with the Administration's position on funding for specific programs or activities. As soon as the President's FY 1994 Budget is released I would be pleased to provide you with the Department's views.

Over the past five years, I have helped establish and administer programs such as the Sustainable Agriculture Research

and Education (SARE) Program, the Regional Aquaculture Centers, and the work of the Office of Agricultural Materials -- all of which received high marks at the grass roots level. I have seen the tremendous progress that can be made working cooperatively with private entrepreneurs.

Products having tremendous market potential include newsprint, poultry litter, and pressboard from kenaf; lubricants and specialty polymers from crambe and rapeseed; degradable polymers from starch, and cosmetics and lubricants from lesquerella. Increased use of these products and others can have a positive effect on farm income, aid rural development and help our nation meet nutritional, environmental, and energy security goals. Having witnessed the development of these products and crops first hand in the Office of Agricultural Materials bolsters my confidence in the AARC Center concept.

My conviction is further strengthened by the fact that the AARC Board of Directors is comprised of experienced businessmen and entrepreneurs. In getting to know the AARC Board members personally, I have developed great trust and respect for the breadth of knowledge and experience they possess, individually, but even more so collectively. I enthusiastically accept the charge of the AARC Board to "make it happen."

Why Private/Public Partnerships?

The challenge today is not a shortage of promising ways to convert renewable materials into useful products, but the lack of support for bringing them far enough along to attract private investment. According to Peter Cannon, chief executive officer of a Silicon Valley start-up company:

> "For every dollar spent in a lab on research for a project, ten dollars are required to develop the research, and a hundred dollars are required to bring production on line."

Some examples of pre-commercial development activities are:

- identifying viable market needs;
- designing equipment;
- testing products for performance and consumer acceptance;
- obtaining regulatory clearance;
- scaling up prototype equipment to a commercial scale;
- verifying that the technology performs on a commercial scale, and;
- developing technical, cost, price, and other economic data for financial institutions.

The rate of investment in these developmental activities for new industrial uses of agricultural materials in the U.S. is

lower than in Japan and the European Community (EC), in part because their governments give more support to commercialization. Private firms alone will not wait the five to ten years it generally requires to obtain adequate returns on promising technologies. Typically, their time limit is two years or less. In addition, many of these new uses have social benefits which the private sector cannot be expected to finance on its own, such as:

- substituting degradable materials for one-time-use plastic containers that will not degrade in the environment;

- reducing air pollution in our congested cities;

- processing value-added products in rural America that leads to creation of jobs and economic activity;

- encouraging farmers to grow crops and animals for changing markets rather than for the current farm program.

Case Proposals

In his testimony, Ralph Hardy described the competitive process the AARC center is currently going through to decide which projects should be funded. To illustrate their potential impact, two case proposals will be examined in more detail.

Case 1 -- Biomass to Ethanol Facility

One proposal's intent is to build and operate a succession of biomass to ethanol facilities in conjunction with co-generation capability. In order to do this, the technology must be demonstrated on a commercial scale for the financial, engineering and business communities. That is where AARC comes into the picture. By AARC being a partner in the first operation, the company can attract other business partners and convince financial institutions to borrow money at more favorable terms. For a $1.0 million investment by AARC, $7.0 million is invested by private partners to get this initial facility up and running. Built into this plan is an arrangement for AARC to have its $1.0 million investment returned to the revolving fund so it can be used for other projects.

The feedstock for this initial facility is waste wood and paper that now goes into a landfill, plus switchgrass. Using conservative assumptions for feedstocks, chemicals, utilities and product sales, the project is expected to produce net pre-tax revenues of $3.5 million on gross sales of $22.6 million. Using the current value of switchgrass as an example, this facility would add $10.00 in value in products like fuel-grade ethanol, feed and CO_2 for every $1.00 of raw material cost. The direct job requirements for this first facility is estimated at 47 workers. Indirect job creation is estimated at two to three times that amount.

The potential impact of a successful demonstration of this facility is enormous. Rather than using only corn as a source material for ethanol, a wide diversity of lower cost cellulosic materials can be employed. This market would create value for grass, legume, and tree crops that are now grown on CRP lands, and allow farmers to move toward more sustainable farming practices.

Case 2 -- "Newstone" from Waste Paper and Soybean Meal

Newstone is a decorative material which looks like granite, but is made from high protein soybean flour and recycled newsprint. This material is four times harder than red oak and may be used in a variety of traditional wood, and or stone product applications. By weight, Newstone contains 45% soy flour, 45% recycled newsprint and 10% additives.

The private firm's objectives are to:

- Develop a pilot plant operation directed toward producing NewStone material sufficient to develop prototype products for the market.

- Maximize production rate of the process equipment and material recipe formulas.

- Develop and implement product, process, equipment and technology licensing to potential joint venture partnerships within the U.S. and internationally.

- Develop a fully automated plant for large scale production to feed various large markets in the U.S. and major foreign countries.

To carry out these objectives requires $7.2 million over four years, and they are requesting $2.0 million from AARC. By the end of four years the company projects annual sales at $39 million. This sale volume would use 280,000 bushels of soybeans and 11.8 million pounds of waste paper. This product provides a meaningful market potential for soybean producers and an outlet for waste paper. Soybean producers -- through their check-off funds have invested $300,000 in R&D for Newstone. Anticipated direct employment in this facility is 300 people. Growth beyond this initial effort looks very promising.

These cases represent only a few of the opportunities that are out there. At least half of the 400 pre-proposals that were submitted to AARC could legitimally use some start-up funds to get underway. It was very difficult for the AARC Board to turn them away.

Regional Centers

The AARC legislation provides for the establishment of two to six regional centers around the country once the annual appropriation exceeds $5.0 million. The AARC appropriation for FY 1993 is $7.25 million, and the conference agreement provides for the designation of two centers.

Based on my experience in the Sustainable Agriculture and Aquaculture programs, having regional administrative centers can actually save program dollars -- especially when the host institutions must share the costs of operating the center -- as required in the AARC legislation. When competitive programs are run from Washington, D.C., costs are higher for the following reasons: 1) business and panel review members must come to Washington at program expense; 2) program support is more expensive -- because there is more competition for office space and qualified people in the Washington, D.C. area than most other parts of the country; and 3) opportunity for more direct interaction with proposal generation and implementation.

On December 23, 1992, there was a Federal Register announcement requesting proposals to host regional centers. The AARC Center Board envisions these regional centers as extensions of the National AARC Center. They will help identify promising projects and build networks involving government, industry, and universities to support and encourage new products from agricultural materials. Proposals were due on February 19, and the Board is now going through a review process.

There is considerable interest in being a regional center even though there is little money involved. Their primary responsibilities are to:

- Establish an Advisory Council composed of processors, marketers, producers, scientists, and financial interests.

- Have the Advisory Council recommend the best opportunities to commercialize new non-food, non-feed products that will contribute to economic growth in the rural areas of the region.

- After going through a competitive review process -- as designed by the AARC Board -- make recommendations on which regional projects should be funded.

- Monitor funded projects.

One reason for the high interest in becoming a regional center is because they can become a focal point of activities in finding new industrial uses for agricultural materials. Decisions on where Regional Centers will be located are based on the following criteria:

- Ability to fully share the administrative costs of operating the regional center;

- Qualifications to carry out the regional center activities;

- Geographic distribution; and

- Enthusiasm, desire, and creativity demonstrated in championing the cause.

CONCLUDING REMARKS

Why should taxpayers invest in joint private/public partnerships to develop new industrial products from renewable materials? Compelling reasons include:

- Research has shown that finding new uses for farm commodity program crops will reduce program payments, lessen farmers' reliance on the programs, and generate benefits to consumers of the new product. With the increased planting flexibility of the 1990 Farm Bill, even greater benefits, including environmental gains, are expected to follow the development of new uses for new crops.

- Taxpayers have a long tradition of funding agricultural research - and have received impressive returns on this public investment. Most of this research has focused on increasing yields and reducing the costs of producing traditional crops, which in some cases ends up increasing commodity program payments. On the other hand, commercialization of new industrial uses increases demand for agricultural materials and

therefore should reduce the need for federal commodity program payments.

- In general, farm-grown raw materials impose fewer environmental costs than synthetic sources -- especially materials derived from petroleum.

- Rural communities will benefit more from new value-added processing facilities that create jobs, income and environmental improvement than from continuing to export raw commodities such as feed grains, wheat, hides and logs.

Looking ahead, the commercialization of new products from renewable agricultural commodities is expected to generate an interlocking, self-reinforcing network of economic and environmental benefits.

Mr. Chairman, that completes my testimony. I will be glad to respond to questions you or the other members may have.

ALTERNATIVE AGRICULTURAL RESEARCH AND COMMERCIALIZATION

Purpose Statement

The Alternative Agricultural Research and Commercialization Act of 1990 (7 U.S.C. 5901 et seq.) authorized the provision of assistance on a competitive basis to foster the development and commercialization of new nonfood, nonfeed products derived from agricultural and forestry commodities. Development of nontraditional uses for farm, ranch and forestry products provides an opportunity to improve U.S. competitiveness in foreign markets, create development and employment opportunities in rural areas, address environmental concerns and lower farm program costs. Programs are managed by the Alternative Agricultural Research and Commercialization Center which was established by the Secretary of Agriculture on March 18, 1992. Program policy and oversight is provided by a Board which is composed of Federal and private sector scientists, producers, and business experts. As of September 30, 1992, there were three full-time employees.

ALTERNATIVE AGRICULTURAL RESEARCH AND COMMERCIALIZATION (AARC)

Available Funds and Staff-Years

1992 Actual and Estimated, 1993 and 1994

Item	1992 Actual Amount	1992 Actual Staff-Years	1993 Estimated Amount	1993 Estimated Staff-Years	1994 Estimated Amount	1994 Estimated Staff-Years
AARC	$4,500,000	2	$7,250,000	7	$20,000,000	7
Obligations under other USDA appropriations:						
Anticipated reimbursements	- -		200,000		200,000	
Total, Other USDA Appropriations	- -		200,000		200,000	
Total, Agriculture Appropriations	4,500,000	2	7,450,000	7	20,200,000	7
Total, AARC	4,500,000	2	7,450,000	7	20,200,000	7

	1992 Actual	1993 Estimated	1994 Estimated
Full-Time Equivalent Staff-Years:			
Ceiling	2	7	7

ALTERNATIVE AGRICULTURAL RESEARCH AND COMMERCIALIZATION

Permanent Positions by Grade and Staff-Year Summary

1992 and Estimated 1993 and 1994

Grade	1992 Hdqtrs	1992 Field	1992 Total	1993 Hdqtrs	1993 Field	1993 Total	1994 Hdqtrs	1994 Field	1994 Total
Executive Level IV	1	-	1	1	-	1	1	-	1
GS/GM-15	-	-	-	1	-	1	1	-	1
GS/GM-14	1	-	1	-	-	-	-	-	-
GS/GM-13	-	-	-	-	2	2	-	2	2
GS-11	-	-	-	1	-	1	1	-	1
GS-9	1	-	1	1	-	1	1	-	1
GS-6	-	-	-	1	-	1	1	-	1
Total Permanent Positions	3	-	3	5	2	7	5	2	7
Unfilled Positions end-of-year . . .	-	-	-	-	-	-	-	-	-
Total, Permanent Employment, end-of-year	3	-	3	5	2	7	5	2	7
Staff-Years: Ceiling	2	-	2	5	2	7	5	2	7

ALTERNATIVE AGRICULTURAL RESEARCH AND COMMERCIALIZATION

CLASSIFICATION BY OBJECTS

1992 and Estimated 1993 and 1994

	1992	1993	1994
Personnel Compensation:			
Headquarters	$94,238	$254,000	$260,000
Field	- -	96,000	100,258
11 Total Personnel Compensation...........	94,238	350,000	360,258
12 Personnel Benefits	6,407	70,000	74,285
13 Benefits for former personnel	- -	- -	- -
Total Pers. Comp. & Benefits .	100,645	420,000	434,543
Other Objects:			
21 Travel	37,184	70,000	191,000
22 Transportation of things	19	1,000	2,000
23.3 Communications, utilities & miscellaneous charges	2,164	15,100	15,100
24 Printing and reproduction.	0	12,000	12,000
25.1 Consulting..............	0	6,000	15,000
25.2 Other services	93,121	321,022	1,811,857
26 Supplies and materials ...	7,933	3,500	3,500
31 Equipment	7,812	15,000	15,000
41 Grants, subsidies and contributions	97,812	10,539,688	17,500,000
Total other objects..........	246,045	10,983,310	19,565,457
Total direct obligations	346,690	11,403,310	20,000,000

Position Data:

	1992	1993	1994
Average Salary, GM/GS positions	$45,691	$41,623	$41,623
Average Grade, GM/GS positions	11.50	11.17	11.17

ALTERNATIVE AGRICULTURAL RESEARCH AND COMMERCIALIZATION

The estimates include proposed changes in the language of this item as follows (new language underscored; deleted matter enclosed in brackets):

<u>ALTERNATIVE AGRICULTURAL RESEARCH AND COMMERCIALIZATION</u>

For necessary expenses to carry out the Alternative Agricultural Research and Commercialization Act of 1990 (7 U.S.C. 5901-5908), [$7,250,000] <u>$20,000,000</u> is appropriated to the Alternative Agricultural Research and Commercialization Revolving Fund.

ALTERNATIVE AGRICULTURAL RESEARCH AND COMMERCIALIZATION (AARC)

Appropriations Act, 1993	$7,250,000
Budget Request, 1994	20,000,000
Increase in Appropriations	+12,750,000

SUMMARY OF INCREASE

Item of Change	1993 Estimated	Pay Costs	Other Changes	1994 Estimated
AARC	$7,250,000	+$22,000	+$12,728,000	$20,000,000

PROJECT STATEMENT
(On the basis of available funds)

Item	1992 Actual Amount	1992 Actual Staff Years	1993 Estimated Amount	1993 Estimated Staff Years	Increase	1994 Estimated Amount	1994 Estimated Staff Years
1. AARC	$346,690	2	+$11,403,310	7	+$8,596,690	$20,000,000	7
Total obligations ..	346,690	2	+11,403,310	7	+8,596,690	20,000,000	7
Unobligated Balances Available:							
Start of year	- -		-4,153,310		+4,153,310	- -	
End of year..	+4,153,310		- -		- -	- -	
Total, Appropriations	4,500,000	2	+7,250,000	7	(1) +12,750,000	20,000,000	7

EXPLANATION OF PROGRAM

Funds were appropriated for the Alternative Agricultural Research and Commercialization (AARC) program into the AARC Revolving Fund. The Revolving Fund will also contain fees and royalties, donations and other funds received by AARC. Funds support the development and commercialization of new industrial and consumer products and uses for agricultural and forestry materials, with preference for projects that benefit rural communities and are environmentally friendly. Development and commercialization of new commodities will: result in new products for consumers and new markets for farmers; enhance the marketability and economic viability of industrial products in global markets; bridge development and marketing efforts among manufacturers, private and government laboratories, universities, and financiers; facilitate and broker the exchange of information about projects that use agricultural and forestry materials in industrial products; and impact economic development in rural areas and create new jobs. Pre-proposals have been solicited that focus on products/processes from the following material categories: Starches/Carbohydrates, Fats and Oils, Fibers, Forest Materials, Animal Products, and Other Plant Materials used as pharmaceuticals, fine chemicals, encapsulation agents and rubber.

Support may be provided through competitively awarded grants, contracts and cooperative agreements. Ultimate commercial interest in projects is assured through private sector representation on the AARC Board and project selection criteria that require the matching of funds and incorporate the sharing of resources and risks (cash and expertise). AARC programs complement research on new uses conducted by the Agricultural Research Service and the Forest Service at Federal labs and grant programs managed by the Cooperative State Research Service.

JUSTIFICATION OF INCREASES AND DECREASES

(1) A net increase of $12,750,000 for activities of the Alternative Agricultural Research and Commercialization (AARC) Center.

(a) An increase of $184,000 which reflects a 2.7 percent increase in non-salary costs.

(b) An increase of $22,000 which reflects the annualization of the fiscal year 1993 pay raise.

(c) A decrease of $13,000 for administrative efficiency.

Need for Change. To promote the efficient use of resources for administrative purposes, in keeping with the President's Executive Order, total USDA baseline outlays for these activities will be reduced by 3 percent in fiscal year 1994, 6 percent in fiscal year 1995, 9 percent in fiscal year 1996, and 14 percent in fiscal year 1997.

Nature of Change. In order to achieve this savings, the AARC Center will carefully monitor supply and equipment purchases, printing and reproduction costs, and travel costs.

(d) An increase of $12,557,000 for activities of the Alternative Agricultural Research and Commercialization Center ($7,250,000 available in 1993).

<u>Need for Change</u>. U.S. agriculture has done a marvelous job of producing quality food and fiber at a reasonable cost for both domestic and foreign markets. But it has become a victim of its own success. Over the last three decades the U.S. had acreage reductions/supply controls in place three out of four years with an average of 40 million acres idle out of a 400 million acre cropland base. During the 1980s, USDA paid producers $50 to $200 per acre - depending on the year and program - to idle acreage. The bill totaled over $20 billion in some years and averaged $13 billion per year for the decade. For fiscal year 1992, the commodity program costs were about $12 billion, which does not include export credit guarantees or the export enhancement program.

There is an alternative to this continual outlay of taxpayer dollars to prop up the economic well-being of American agriculture. Renewable materials produced on our nation's farms can satisfy more than just food and fiber needs. They can satisfy a vast array of industrial markets from degradable polymers (plastic substitutes) and oxygenated fuels to lubricants' coatings, and annual fiber crops that can compete with synthetics for many uses and that generally are more environmentally friendly. Many of the over 200 testimonies received by the Board at eight public hearings called for actions in the pre-commercial areas --beyond where public research organizations typically carry their work.

A number of factors have come together to make the use of farm and forest materials in industrial uses more viable in the 90's. They include:

- More efficient technologies for processing and manufacturing, i.e. with biotechnology, continuous fermentation and chemical catalytical process.

- Environmental and regulatory requirements for clean air and water, landfill alternatives, disposability, and renewability.

- Availability of skilled labor and resources in rural America.

- Increased pressure to reduce agricultural subsidies.

The challenge today is not a shortage of promising ways to convert renewable materials into useful products, but the lack of support for bringing them far enough along to reduce risk and attract private investment. Based on Department of Commerce studies and private sector experience, for every dollar spent in a lab on research for a project, ten dollars are required to develop the research, and a hundred dollars are required to bring production on line.

These pre-commercial development activities include:

- identifying market needs;
- designing equipment;
- testing products for performance and consumer acceptance;
- obtaining regulatory clearance;
- scaling prototype equipment up to commercialize size;
- conducting pre-commercial runs; and
- developing technical, cost, price, and other economic data for financial institutions.

Closing this gap between research results and commercial markets is the primary goal of AARC. It is done by: forming private/public pre-commercial partnerships to bring new products or processes to market; reducing risks and expediting products to the marketplace thereby increasing return on research investments; having the private sector take the lead; developing a

portfolio of long-/short-term projects with an initial mix providing significant sales within three to five years; and collecting revenues from successful projects and reinvesting these funds in other projects.

Key differences exist between the AARC Center's mission and operations and those of other USDA agencies. For the AARC Center:

1. Private sector determines activities through the Board of Directors and business involvement in review of proposals.

2. Mission is not research per se, but bridging the gap between research advances and products penetrating the market.

3. Risks are shared through partnerships and the AARC Center invest with the partner financially.

4. Complements ARS, CSRS, and university research by providing a vehicle to expedite advances to the marketplace-- "penned up" demand exists for the program.

5. Authorized to work with any legal entity, by placing emphasis on small firms and entrepreneurs, to provide assistance to move products into the marketplace and the legislation authorizes use of loans to move a new product or process into the marketplace.

Nature of Change. The 1990 Food, Agriculture, Conservation, and Trade Act authorized the AARC Center and in March 1992, a nine person board was appointed to provide policy and program direction. All except one of the board members are non-federal, representing commercial, financial, producer and scientific interests. Initially, eight public hearings were held to obtain input before contemplating policy and program decisions. The Board heard from more than 200 individuals and organizations in Iowa, Georgia, New Jersey, Oregon, California, Minnesota, Kansas, and Texas. Witnesses testified that many rural communities need an economic "shot in the arm" and that new industrial, non-food, non-feed uses of agricultural materials can help provide that medicine. They suggested that the AARC Center should be a catalyst, a coordinator and a facilitator for finding new industrial uses for traditional and new crops, animal by-products, and forestry materials. Themes that were replayed throughout the hearings included: operate like a business; maintain independence; keep the application process simple; leverage your resources; and see yourself as an economic development organization.

On August 17, 1992, the Federal Register listed the first request for pre-proposals. In this initial request, the AARC Center received 407 proposals with total budgets of $448 million of which $175 million competed for the $10 million currently available from the Center (2.5 to 1 leveraging of Federal dollars). Based upon reviews already conducted, at least half of these projects have merit. In March 1993 the Board reviewed 48 full proposals requesting $30 million.

One of the Board's key criteria is how fast a product can be brought to the marketplace. Many of the proposed products can reach the market within a few years if the applicant is provided the risk capital that is not available from the private sector, especially for new products being introduced by small entrepreneurial firms. Many examples of the type of products could be provided. Illustrative are these:

New Stone. A product that uses equal portions of soybean and used newsprint to make a material that looks like polished granite, but can be readily worked with woodworking equipment.

Automotive Windshield Washer. Would replace methanol from petroleum with ethanol made from renewable materials.

Starch Base Polymers. From corn, wheat, and potatoes for non-recyclable, disposable plastic items such as food packaging, personal care items, and medical products.

Chemicals including Ethanol from Cellulosic Material. Proprietary technology to convert cellulose material such as grass straw (previously disposed of by open field burning) and soil conserving perennial grass crops that can provide farmers an economical, sustainable option when land in the Conservation Reserve Acreage comes out of the government rent program beginning in 1995.

Funds will support development of new products from agricultural materials. Availability of new tools, such as biotechnology, advanced process engineering techniques, super critical fluid technology, computer-aided process design, selective separations technologies, innovative use of catalysts, in-situ polymerization, and chemical release controls offer significant opportunity for the development of novel products to meet consumer and industrial demand in domestic and foreign markets. Economic analysis will indicate market opportunities as well as potential agricultural and national benefits. Funds will be allocated consistent with policies and procedures established in the legislation and by the AARC Board.

The AARC Board of Directors will implement the regional administrative centers called for in the 1990 Farm Bill. The legislation does not allow any AARC funds to be used for construction. It is planned to:

1. Distribute funding so that approximately 20 percent of the funding is for technology with biofuels and 80 percent for technology for other industrial uses of farm and forest products.

2. Begin with two Regional Centers in fiscal year 1993.

3. Tie in with existing entities at the state level such as Rural Development or Economic Development Centers.

4. Keep operating costs at each of these centers between $100,000 and $200,000. The host institution must match funds from the Federal government to operate the center.

5. Conduct Regional Center Activities:

   - establish an Advisory Council composed of processors, marketers, producers, scientists, and financial interests.

   - have the Advisory Council recommend the best opportunities to commercialize new non-food, non-feed products that will contribute to economic growth in the rural areas of the region.

   - make recommendations on which regional projects should be funded after going through a competitive review process in evaluating market opportunities and agricultural and national benefits -- as designed by the AARC Board.

ALTERNATIVE AGRICULTURAL RESEARCH AND COMMERCIALIZATION

STATUS OF PROGRAM

Initial funding for the Alternative Agricultural Research and Commercialization (AARC) Center was appropriated in fiscal year 1992. The Food, Agriculture, Conservation, and Trade Act of 1990 (P.L. 101-624, Title XVI, Subtitle G) required the Secretary of Agriculture to appoint a Board of Directors. On November 27, 1991, USDA issued an announcement in the Federal Register seeking nominations for membership on the AARC Board. The Board was appointed on March 6, 1992. One of the nine Board members represents the Department and eight provide experienced leadership from the private sector in numerous key market, processing, production, and scientific areas. This Board's breadth and experience is in harmony with the legislation and provides a market needs perspective as opposed to a technology push approach.

The Board held its first meeting on April 13-14, 1992. At this meeting, the AARC Board scheduled 8 public hearings around the country in May and June. Public hearings were required in the legislation. Moreover, the Board wanted to obtain grass-roots input concerning policy and program options. Over 200 individuals testified during the eight days of hearings; the Board dialogued with those testifying to glean additional ideas. The testimony provided keen insights into market opportunities, technologies, and obstacles in addition to policy suggestions.

Based on the hearings, legislative directives, and experiences, the Board is developing a strategic business plan. It includes four key functional tasks for the AARC Center. They include: serving as a catalyst, facilitator, and coordinator; encouraging development partnerships; funding projects; and managing information. The bulk of the AARC funds will be devoted to funding projects, but the other three areas are also important to the overall AARC Center effort.

Input from the public hearings provided the basis for a request for pre-proposals released in the Federal Register on August 17, 1992. Pre-proposals were due October 30, 1992. The Board will screen these pre-proposals and follow-up to obtain and evaluate full proposals before funding projects. Target date for funding the first AARC projects is in early calendar year 1993.

THURSDAY, MARCH 11, 1993.

EXTENSION SERVICE

WITNESSES

MYRON D. JOHNSRUD, ADMINISTRATOR, EXTENSION SERVICE

MITCHELL GEASLER, ASSOCIATE ADMINISTRATOR, EXTENSION SERVICE

RICHARD R. RANKIN, DEPUTY ADMINISTRATOR FOR MANAGEMENT, EXTENSION SERVICE

STEPHEN B. DEWHURST, BUDGET OFFICER, U.S. DEPARTMENT OF AGRICULTURE

OPENING REMARKS

Mr. DURBIN. Our next panel will be from the Extension Service. I would like to welcome the Extension Service in their appearance before the Subcommittee, the Administrator Myron Johnsrud; the Deputy Administrator Richard Rankin; and the Budget Officer Steve Dewhurst.

We will make your entire statement part of the record. If you would summarize and highlight it, we will proceed.

ADMINISTRATOR'S STATEMENT

Dr. JOHNSRUD. Thank you, Mr. Chairman. In addition I have with me our Associate Administrator, Dr. Mitchell Geasler.

In the essence of time, I intend to be very brief. I did provide a statement that provides a little background of what has happened recently in the Cooperative Extension System.

I would like to highlight a couple of things and then conclude my comments.

I want to emphasize for the record that our business is taking that science knowledge and research and try to get it into application. That is when that science knowledge starts to bubble economically; when its gets to be applied. That is really the business of the Extension Service.

Extension does this through education and information across the country and through the Land-Grant University System with many other partners. Within the Cooperative Extension system there is currently, a $425 million Federal appropriation leveraging that, the State and local governments appropriate another billion dollars. That is a mix of the partnership.

There are a couple of things I want to mention that relate to how Extension does business. First, we made some pretty basic decisions in the mid-1980s that we needed to reassess about how we do business, how do we determine what we do, set our priorities, and carry out our programs.

The partners agreed that issues drive our agenda. The needs of the people we serve are on our educational agenda, and at the same time, we try to influence the research agenda to insure a good science base.

Second, the System made a decision that much of that refocusing would be within current resources and we have done a pretty good job of that.

Third, we needed to apply the new world of educational technology and computer technology to how we go about doing our business. We really have moved with very positive and effective results in using everything from the National Research and Education Network and the infrastructure that goes with that, the Super Data Highway.

We have capacity, through facilities at USDA, to have a Nationwide Audio Video Satellite System. We are using that to enhance our capacity to reach out and work with public and private organizations in the use of that system.

Those are a couple of things I would mention on how we are doing business differently focusing crisply on issues and utilizing new technology. These changes have been positive. Focusing on issues has caused stress and strain on the System. Some people feel we have left programs behind that we shouldn't have, but we are involving an extensive network of people in helping us set those directions and I am comfortable that we are putting resources on the right issues.

That concludes my comments.

[CLERK'S NOTE.—The Administrator's prepared statement appears on pages 343 through 350. The budget justifications, which were received on April 28, 1993, appear on pages 351 through 394.]

NUTRITION EDUCATION

Mr. DURBIN. I noticed that you obviously have a responsibility in nutrition education. I also notice that some of the people who are served by your program are currently either in the WIC program or in the Food Stamp program.

You have stated that approximately 44 percent of the EFNEP clientele are also WIC participants, 92,000 participants in fiscal year 1990. What is it that you provide through Extension that is not available through the current WIC program?

Dr. JOHNSRUD. At the local level, Extension conducts the Expanded Food and Nutritional Education Program, which targets some of the same clientele as the WIC program. Extension adds an intensified education effort that the WIC program doesn't provide.

EFNEP is a hands-on program directly working with families on how to better utilize their available resources through any source, food commodities or assistance, and how do you best use their resources to feed your family most effectively.

Extension uses the opportunity of location of sites. We work with the agency and intercept the families at the place where they interact with WIC. We also refer them to WIC.

Mr. DURBIN. In addition to the $60,525,000 appropriated in 1993

for EFNEP, the Congress also provided $3,530,000 for additional nutrition education to WIC recipients. Specifically, how is this $3,530,000 being used?

Dr. JOHNSRUD. The funds are being used in two ways. First, all of our state Extension partners have had an opportunity to develop a Plan of Work to implement this initiative to provide intensive nutrition education to WIC clientele. We will be providing $30,000 to each state based on this approved Plan. Second, we requested applications for project proposals for the development of programs that focused on this specific audience. The proposals are currently under review and we anticipate awarding funds in the near future. There was an impressive variety of proposals, with broad geographic representation and different audiences, including pregnant adolescents and women, lactating women, infants and preschoolers. The plan is to fund about 14 or 15 proposals up to $100,000 each.

Mr. DURBIN. Have the states provided any matching funding for this program? If so, how much?

Dr. JOHNSRUD. The states were required to redirect funds or secure additional resources that equaled at least one-half the amount received in Federal funds. It is estimated that our partners will provide an additional $1 to $1.5 million for this program.

Mr. DURBIN. Dr. Johnsrud, as the educational agency of the Department, how do you coordinate your activities with other agencies and programs that also provide education services to maximize benefits and not duplicate efforts?

Dr. JOHNSRUD. In regard to USDA agencies, Extension Service is, as you stated, the educational agency of the Department. We coordinate around program topics and issues involving those agencies and programs that relate to the specific topic or issue. This coordination occurs from Federal to State to local levels. This approach brings the cumulative impact of the realized resources to bear on the need and minimizes duplication of effort. As for Extension's work with other Federal agencies, the situation is usually one of mutual interest. In working with the Departments of Justice, Labor, HHS, EPA, or DOD, the established educational Extension system is sought out in order to address the critical issue and deliver the program. Our activities are not duplicative of the programs of the agencies with which we collaborate.

Mr. DURBIN. Most agencies that deliver food assistance provide nutrition information and some also provide a specific shopping list of eligible products at local stores. What do you add to that, beyond the current counseling in the WIC program for these 92,000 people?

Dr. JOHNSRUD. It is one thing to provide a list. It is the next thing to help people learn how to use the list.

Giving information to people is pretty easy. Getting them the educational program to apply and use it, the behavioral change; the know how; the comfort and the change in habits are all part of that education.

Mr. DURBIN. Tell us specifically how you coordinate your nutrition education efforts with WIC program personnel.

Dr. JOHNSRUD. For many years, the EFNEP has worked with WIC to reach low income families with nutrition education. Over the past five years, approximately 40–45% of the total EFNEP clientele also received WIC benefits. The range of cooperation varied

from cross-referral systems, conduct of classes at WIC clinics, shared training sessions and similar activities. This past experience provided a base of experience in working together, but also identified areas where improvements could take place.

For FY '93, there is new funding for an ES/WIC Nutrition Education Initiative. The goals of this Initiative are: to increase interagency collaboration, to improve knowledge and skills in areas such as food selection, purchasing, storage, safety and preparation, and to improve behaviors such as breast feeding, initiation and duration, diets for pregnant women, infants and young children and management of food resources. To implement this Initiative, ES is providing funds to States in two ways.

All States and territories were eligible to receive $30,000 based on an approved plan of work. Thus, for plans of work from 52 States and territories have been reviewed and are in the approval process. In addition, there were opportunities to submit competitive proposals for projects at up to $100,000. Over thirty responses were received for this effort. For both funding streams, the plans and proposals were jointly developed between ES and WIC State or local staff. This joint planning included the identification of the target audience, focus of the nutrition education, training to be conducted and evaluation methodology. There is a high level of excitement about the new opportunities for collaboration that is Initiative provided.

Mr. DURBIN. What percent of the total EFNEP funds were devoted to families on food stamps, the WIC program, or other Federal food assistance programs in fiscal year 1992?

Dr. JOHNSRUD. In FY 92, approximately 63 percent of the EFNEP families were also Food Stamp participants, 47 percent were WIC participants and 61 percent participated in other Federal food assistance programs. There was no specific designation within the EFNEP allocation to reach these audiences, although we have made increased efforts to work collaboratively with these programs.

Mr. DURBIN. Last year, you provided the Committee with a table showing the number of participants that received assistance under EFNEP from 1987 to 1993. Would you update this table for us?

Dr. JOHNSRUD. I will provide that for the record.

[The information follows:]

Year:	*Number of participants*
1987	517,163
1988	556,918
1989	615,639
1990	641,639
1991	677,837
1992	667,187
1993 (estimate)	670,000

Mr. DURBIN. What is the status of the establishment of a Cooperative Extension System Center for Child Nutrition Education at the Children's Nutrition Research Center in Houston?

Dr. JOHNSRUD. We are very pleased to announce that our efforts to provide a closer link between the Extension Service and the ARS Children's Nutrition Research Center are well underway. We are ready to sign a Memorandum of Understanding between ES,

ARS, and Baylor College of Medicine. To get the activity off to a quick start, we identified a nutrition specialist within the CES with extensive experience in developing and delivering maternal nutrition education. We have signed an Intergovernmental Personnel Act agreement to detail this person to Houston, Texas for six months to initiate this effort. The IPA began at the Center in March.

Through this new link, we expect to provide CES with ready access to the latest research being developed within the USDA Human Nutrition Research Center and will facilitate the identification and sharing of research needs from the perspective of CES.

FUNDING LEVELS

Mr. DURBIN. You have been the director of the program for seven years; is that correct?

Dr. JOHNSRUD. Yes, Sir. I have been on this job seven years.

Mr. DURBIN. In terms of your funding levels, give me a general idea of what you have faced during that period of time?

Dr. JOHNSRUD. We have faced a couple of interesting challenges. One, is the challenges that the Congress has to make in deciding about Federal appropriations. These have been very difficult during that period of time. In the majority of our State Extension Services, where the billion dollars comes from, their legislatures are going through exactly the same thing.

There have been at least 30 States that have had very challenging situations. During the seven years that I have worked in this job, our Federal appropriations have increased by about $100 million.

The State and county appropriations have proportionally gone up much faster. We have kept close to the cost of doing business, but it required shifting of resources to deal with new issues that arise.

AGRICULTURE PROGRAMS

Mr. DURBIN. Could you give me a rough approximation of the percentage of effort or extension resources that go directly towards working with farmers as opposed to those who are not farmers; I mean farmers, ranchers, and agricultural producers in general?

Dr. JOHNSRUD. I can give it to you best by the type of program. We don't collect information on the type of clientele because sometimes when you deal for example with the matter of food safety, it is of great concern to farmers and producers of the foods. Additionally, we will do programs in the area of food safety to help consumers understand the high quality and the nature of the food which has a direct implication for the farmer.

Our best estimate, based on plans from the System, is about 47 percent of our total resources nationwide. This is a figure that relates to those who manage agricultural and natural resources.

Mr. DURBIN. Relating to agriculture?

Dr. JOHNSRUD. Yes, sir. Relative to agriculture and natural resources which are the managers of the resources on the land.

FIELD OFFICES

Mr. DURBIN. You have an Extension Service Office in Washington, D.C.?

Dr. JOHNSRUD. Yes. There is one at the University of the District of Columbia. This is not a USDA office, but is the location of the District of Columbia Cooperative Extension Service.

Mr. DURBIN. There is a lot of talk about consolidation of offices and services within the U.S. Department of Agriculture. Has this consideration reached the Extension Service in terms of where you are going to be doing business in the future?

Dr. JOHNSRUD. In terms of field offices, if that is what you were referring to, Mr. Chairman, the Extension Service was directly involved in the deliberations and the discussions and decisions that went on within the department in the past year and our Associate Administrator, Dr. Geasler was on that team.

If you want more specifics, he was in the middle of it. The offices located in the field with the exception of the Extension Service, are USDA offices. Extension Service offices are designated and located by the university. They are not USDA offices. That was understood in the process.

At the same time, we didn't opt out of being a partner in the discussion, because we work together. We were a real part of this effort.

I commend our State Extension Services for providing data to the teams working on this at the national level just as other agencies did. There is a distinction that will be needed when it comes time to decide on the plan. It has to be decided at the State and local level because those are not USDA offices.

URBAN GARDENING

Mr. DURBIN. Tell me about the Urban Gardening program.

Dr. JOHNSRUD. It is in 23 cities across the United States. It focuses on helping families, including the young family members, how you really raise nutritious and meaningful supplies of food in a city environment. It also provides, in many ways, a focal point for everything from an education program in a school system. Some of the schools operate the program over the noon hour so it becomes a part of the school enrichment.

There are 800 acres in the urban areas in 23 cities. There is about $22 million worth of food raised each year.

Mr. DURBIN. How much does the program cost us?

Dr. JOHNSRUD. $3.5 million in this current fiscal year. Some money comes in from the localities where the programs are located.

I had occasion to be in Los Angeles a month after the bad scene there last year. I went into the areas where the disturbance occurred and the one thing that was not disturbed was the garden sites and sheds on these sites and all that because there was community pride.

It was pretty heartening to talk to people that had gardens in there and what it meant to them.

Mr. DURBIN. Information you provided at last year's hearing indicates that the number of volunteers in the Urban Gardening pro-

gram has decreased over the years. How do you explain this change in voluntary participation?

Dr. JOHNSRUD. We currently have I think 1,300 volunteers that help the 100 staff. I can't recall, Mr. Chairman, what the number was the year before.

Mr. DURBIN. Let me give you an example. In 1986 there were 3,690 volunteers, in 1990 this number was 2,535.

Dr. JOHNSRUD. That is over about a six-year period there?

Mr. DURBIN. Four-year period.

Dr. JOHNSRUD. I don't know. The only thing I could surmise is that funding for that program has been the same for many years so the purchasing power was biting into the number of staff hired to support the volunteers. It may be there has been a reduction in number of professional staff that work with volunteers. I am not sure whether it was a good or bad change in terms of affecting the program.

Mr. DURBIN. Well, in 1987, the number of participants in the program, was 199,357 and, 3,857 volunteers. Three years later, in 1990, there were 196,281 participants, but the number of volunteers went down to 2,535. You lost over 1,300 volunteers or a third. In the same timeframe, the program lost roughly one-and-a-half percent of its participants, and 33⅓ percent of volunteers.

What does that tell us?

Dr. JOHNSRUD. I don't know the ratio between the participants and the volunteers. I would have to go to our technical people that give leadership to that program.

We would be happy to provide that because I don't have the information here.

[The information follows:]

We don't believe that the reduced number of volunteers indicates a decrease in community support. While there is no consistent pattern among the participating cities, we think that reduced staff numbers has resulted in less effort to recruit, train, and retain volunteers.

Mr. DURBIN. Please update the table that appears on page 561 of last year's hearing record which shows the number of participants and volunteers for the urban gardening program to include fiscal year 1991, as well as a breakout of both Federal and non-Federal dollars available for all fiscal years.

Dr. JOHNSRUD. I will provide that for the record.

[The information follows:]

Fiscal year	Funds		Number of	
	Federal	Non-Federal	Participants	Volunteers
1986	$3,329,000	---	225,466	3,690
1987	3,329,000	$1,341,455	199,357	3,857
1988	3,329,000	1,642,054	188,243	3,007
1989	3,500,000	---	197,332	3,206
1990	3,474,000	1,437,537	196,281	2,535
1991	3,557,000	1,900,673	167,275	2,425
1992	3,557,000	942,305	144,002	2,188

Mr. DURBIN. Please update the table that appears on page 562 of last year's hearing record showing the total value of food produced under the urban gardening program.

Dr. JOHNSRUD. I will provide that for the record.

[The information follows:]

Fiscal year:	*Estimated values ($)*
86	16,760,584
87	17,615,000
88	16,945,850
89	22,831,313
90	24,008,453
91	26,000,000
92	33,705,831

Mr. DURBIN. Also, provide for the record a list of cities where the program operated, the budget for each city, and the amount of non-Federal funds each received for fiscal year 1992 and proposals for fiscal year 1993.

[The information follows:]

	Fiscal year 1992	
	Federal	Non-Federal
Phoenix, AZ	$108,500	$0
Los Angeles, CA	241,500	50,000
Denver, CO	96,000	100,000
Bridgeport, CT	72,500	18,200
Jacksonville, FL	145,000	57,000
Atlanta, GA	101,000	47,000
Honolulu, HI	291,000	20,000
Chicago, IL	108,500	4,562
Indianapolis, IN	72,000	3,000
Louisville, KY	145,000	500
New Orleans, LA	145,000	11,450
Boston, MA	145,000	3,000
Baltimore, MD	145,000	34,850
Detroit, MI	145,000	11,563
St. Louis, MO	145,000	13,535
Newark, NJ	145,000	37,071
New York, NY	485,000	12,500
Cleveland, OH	145,000	49,230
Philadelphia, PA	145,000	150,000
Memphis, TN	145,000	31,850
Houston, TX	145,000	57,438
Seattle, WA	96,000	6,838
Milwaukee, WI	145,000	222,318
Total	3,557,000	942,305

NATIONAL INITIATIVES

Mr. DURBIN. You list eight national initiatives of the Extension System in your opening statement. Would you provide a brief description of each initiative for the record, including the funding level for each?

Dr. JOHNSRUD. National initiatives are the Cooperative Extension System's commitment to respond to important societal problems of broad national concern with additional resources and significantly increased effort to achieve a major impact on national priorities.

They are the current most significant and complex issues for which the Extension System has the potential to make a difference. National initiatives rise from the base programs to receive special emphasis for a relatively short time. There are no specific funding levels for the National Initiatives. However, we will provide the number of staff years allocated within the State Extension Services for each of the initiatives. Approximately 2,923 of the total staff years are allocated to the initiatives. This is about 18% of the total. total.

[The information follows:]

COMMUNITIES IN ECONOMIC TRANSITION (2.8%/437 SY's)

In response to the economic crisis impacting many small communities and urban neighborhoods, the Cooperative Extension System Initiative focuses on strategic economic development and enterprise development/business assistance for small and rural communities.

Under strategic economic development, Extension assists community leaders with effective economic development strategies; works with small and rural community leaders to develop strategic plans for economic development; provides reports, data interpretation, trend analysis, and strategy insights to local leaders; and provides leadership for local issues by collaborating and cooperating with federal/state agencies and organizations.

Under enterprise development and business assistance, Extension provides training opportunities for small business owners; provides technical support to business firms via EXPERT teams; assist small and rural communities in enterprise development; provides global marketing assistance to firms; and provides for innovation and creativity in economic diversification among small and rural communities.

FOOD SAFETY AND QUALITY (2.0%/320 SY's)

Extension's Food Safety and Quality Initiative focuses on improving the ability of all parts of the food system to make informed, responsible decisions about food safety and quality issues. The CES can draw on the expertise of community-based Extension professionals nationwide to educate Americans in food safety and quality issues.

Ensuring and communicating food safety requires the innovative educational approaches currently being used by the Cooperative Extension System nationwide. Several model programs are underway that target educating particular segments of the public and the food production system.

Extension created 36 model programs nationwide in the following target areas: understanding of scientific and policy basis of risk management, risk management practices for youth, enhanced use of the Food Animal Residue Avoidance Databank, HACCP models and training materials, and risk of foodborne illness for vulnerable individuals.

DECISIONS FOR HEALTH (NEW INITIATIVE. STAFF YEAR ALLOCATION NOT AVAILABLE)

Cooperative Extension's national health agenda, Decisions for Health, will promote healthy lifestyles, improve access to affordable health care, and expand the ability of communities to strengthen their health-related infrastructure through three goals: personal decisions for health; personal and organizational decisions for access and affordability; and community decisions for health.

The vision for this Initiative is:

The Nation's citizens will maintain health lifestyles and affordable health care will be available to each community. As a result of communitywide decisionmaking processes, communities will expand their capacity to provide health care, thereby improving the quality of life.

The Cooperative Extension System—working in partnership with the health community—will encourage rural and urban people, including those employed in agriculture, to live healthy lifestyles by reducing risk behaviors, by engaging in the early detection of disease, and by making appropriate use of an affordable health care system.

Communities will build their capacity to provide affordable health care to all residents through community decisionmaking processes for designing and delivering programs targeted to local needs.

Plight of Young Children (New Initiative. Staff Year Allocation Not Available)

Utilizing a comprehensive program approach, and drawing on the expertise of community-based Extension professionals, the CES is expanding its current outreach to children aged prenatal to 5 years and their families.

Extension's objectives under its new Plight of Young Children National Initiative are to: create community coalitions and build on successful paraproffessional models that support children; provide access to comprehensive education; and improve families' skills in nutrition, money management, and parenting.

Sustainable Agriculture (3.8%/625 SY's)

The Sustainable Agriculture Research and Education (SARE) program of the Food, Agriculture, Conservation, and Trade (FACT) Act of 1990 (Subtitle B of Title 16) mandates sustainable programs. Extension staff nationwide are developing information, education, and demonstration programs that promote economically sound, socially acceptable, and environmentally friendly agriculture. This includes:

Developing people and data networks that enhance the transfer of practical, reliable, and timely information to farmers and ranchers;

Analyzing and evaluating technologies that ensure the development of globally competitive, environmentally sound agricultural systems;

Validating research demonstrations that illustrate the effectiveness of sustainable methods and practices in whole-farm systems;

Providing technical training for Extension and other professionals involved in developing sustainable agriculture systems; and

Providing appropriate technical guides and/or other education materials that promote the practical application of sustainable whole-farm-systems.

Waste Management (1.6%/258 SY's)

Extension's Waste Management programs assist communities implementing cost-effective, integrated waste management systems based on maximum reduction, recycling and processing of waste, and state-of-the-art engineered landfills.

Extension's Waste Management Initiatives focuses on educational material development. Extension programs provide a catalyst in stimulating attitudes and behavioral changes of youth, families, farmers, businesses, community leaders, and public officials toward waste management. Extension Service-USDA works closely with other federal, state, and local agencies in developing collaborative efforts.

Water Quality (4.3%/689 SY's)

The Cooperative Extension System (CES) focused its total national network on water quality as a national initiative in early 1988.

The Extension Service U.S. Department of Agriculture (ES–USDA) and CES continue to play a major role in developing and implementating USDA's plan.

The CES Water Quality Initiative has a somewhat broader perspective because it reflects and addresses specific categories of local needs in six major areas. The objectives for this National Initiative are:

Interactions of soils, pesticides, and water quality.

Interactions of soils, nutrients, and water quality.

Importance of drinking water supplies and consumer education on assessing and protecting drinking water quality.

Storage, handling, and using animal waste.

Public policy education.

Staff development and training.

Youth At Risk (3.7%/594 SY's)

Extention's National Initiative on Youth At Risk targets the social and economic implications of ignoring the urgent needs of the next generation of Americans. One goal is to expand Extension's outreach to more youth, particularly to those most vulnerable because of poverty, lack of parental and community support, and negative peer pressure.

Extension's Youth At Risk program focuses on prevention and intervention rather than treatment. Extension staff reach out to young people through an educational delivery network anchored in every community.

Partnerships—working together to benefit youth, families, and communities—are an integral part of Extension's Youth At Risk National Initiative. The Extension

Service, U.S. Department of Agriculture (ES-USDA) works closely with other federal agencies and the private sector to make Youth At Risk programs happen across the country. Extension efforts are not meant to stand alone, but to work together with the local community, particularly the local school system.

EXTENSION AGENTS

Mr. DURBIN. How many Extension agents do you currently have at the state and county levels?

Dr. JOHNSRUD. Currently, there are 16,676 Extension personnel in the nation, 9,574 are County Agent positions.

Mr. DURBIN. Are these agents Federal employees or state and local employees?

Dr. JOHNSRUD. These Extension specialists and agents are, for the most part, employees of the University. Some are employed at the local level. They are not Federal employees.

Mr. DURBIN. As I understand it, there is only one Federal Extension Service office and that's located here in Washington. There are also over 3,000 offices nationwide operated by State Extension Services in cooperation with county and local governments. Do you contribute any funding toward the operating costs of these offices?

Dr. JOHNSRUD. The vast majority of the Federal appropriations to the States, under the Smith-Lever 3b&c formula funds, are used for the salaries and related benefits of the Extension staff at the Universities. The Federal partner does not directly fund the operation of the Extension field offices at the local levels. Any portion of Federal funds for operating the Extension field offices is a State decision.

Mr. DURBIN. What control do you have as to where these offices will be located or how they will be operated?

Dr. JOHNSRUD. The location and operation of Extension offices throughout the country are the providence of the individual State Extension Services. They locate the offices and staffs to best achieve the delivery of programs to their particular clientele. The Federal partner is not involved, in any way, with determining the location, staffing or structure of local Extension offices.

Mr. DURBIN. How will the Secretary's reorganization plans affect these offices, as well as agents at the state and county levels?

Dr. JOHNSRUD. Currently, the State Extension Services are collocated with USDA agencies, such as ASCS, SCS, or Farmers Home, in 704 sites. If any of these sites were affected by relocation or consolidation of the USDA agencies, it is estimated that about 10% of the Extension offices would also make changes in their location or structure.

FUNDING BY STATE

Mr. DURBIN. In last years's hearing record you provided a table which showed the total Extension funding by state for fiscal year 1991. Would you please provide this same information for fiscal year 1992?

Dr. JOHNSRUD. I will provide the information for the record.

[The information follows:]

TABLE III
SOURCES OF FUNDS ALLOCATED FOR COOPERATIVE EXTENSION WORK
FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 199[illegible]

STATES	GRAND TOTAL	TOTAL FEDERAL FUNDS	TOTAL WITHIN STATES	PENALTY MAIL	RETIREMENT	FUNDS FROM FEDERAL SOURCES: ALL OTHER	RENEWABLE RES EXT ACT	RURAL CRISIS RECOV PROG	1890 COLLEGES EXT PROG	1890 COLLEGES FAC PROG	FUNDS FROM NON-FEDERAL SOURCES: STATE (EST)	COUNTY (EST)	NON-TAX (EST)
Alabama	$38,350,661	$13,516,534	$24,080,627	$360,999	$468,976	$7,866,100	$62,681	$ --	$2,648,675	$1,179,601	$20,942,473	$2,292,000	$806,064
Alaska	4,687,697	1,207,967	3,450,000	40,384	34,666	1,060,340	42,665	--	--	--	3,450,000	--	--
American Samoa	979,948	818,948	161,000	17,839	--	801,113	--	--	--	--	150,000	--	11,000
Arizona	10,564,862	2,711,862	7,843,000	169,169	169,384	2,384,164	38,286	--	--	--	7,000,000	516,000	327,000
Arkansas	38,842,601	8,969,679	18,242,839	295,166	481,660	6,330,063	71,346	--	1,153,100	469,305	16,471,966	1,366,616	382,316
California	65,113,668	10,603,668	54,408,000	687,660	61,116	8,837,116	67,300	--	--	--	38,725,000	11,601,000	3,171,000
Colorado	18,101,365	6,681,467	14,646,906	176,061	169,647	6,166,365	46,971	--	--	--	7,507,164	6,766,169	273,666
Connecticut	4,196,690	3,508,463	1,690,687	110,164	8,666	2,348,700	38,746	--	--	--	1,690,687	--	--
Delaware	4,611,673	2,098,976	2,641,096	60,664	46,666	1,661,979	38,746	--	416,464	300,000	2,162,668	66,536	166,096
Florida	48,412,366	8,204,946	36,207,649	409,466	448,164	6,644,794	66,666	--	1,061,651	376,436	16,673,669	17,466,636	646,111
Georgia	61,736,668	12,061,437	36,694,298	466,343	673,406	9,020,720	66,000	--	1,626,302	661,577	36,366,666	6,314,771	4,066,616
Guam	2,177,781	966,661	1,012,070	36,021	--	940,940	--	--	--	--	1,312,070	--	--
Hawaii	7,639,557	1,642,197	6,061,430	77,011	30,166	1,409,171	38,746	--	--	--	6,061,430	--	--
Idaho	11,176,310	3,967,314	3,206,999	141,870	160,609	2,617,963	47,378	--	--	--	6,336,900	1,773,003	97,196
Illinois	39,636,736	11,317,645	27,316,660	630,061	462,467	10,464,627	60,466	--	--	--	21,456,169	2,771,306	3,066,679
Indiana	34,016,734	6,393,706	24,636,666	466,661	366,280	6,616,634	40,960	--	--	--	13,631,632	10,262,066	736,066
Iowa	38,728,680	10,216,033	28,613,643	469,623	614,616	6,639,423	38,746	306,416	--	--	16,116,643	6,667,000	4,600,000
Kansas	38,316,720	6,504,563	26,012,036	331,104	406,617	6,298,743	38,746	379,166	--	--	13,015,046	12,536,330	3,263,164
Kentucky	42,356,096	12,675,660	30,979,466	476,960	686,734	9,166,616	66,612	--	1,613,276	466,478	21,116,610	6,663,666	--
Louisiana	30,033,623	6,640,164	20,493,436	334,327	492,447	6,543,497	66,744	--	1,097,368	1,101,611	16,627,747	666,634	36,667
Maine	7,604,416	3,043,661	5,260,756	109,666	66,286	2,207,627	66,902	--	--	--	4,215,168	640,000	600,600
Maryland	25,776,616	6,671,646	20,107,969	209,167	207,664	2,742,022	38,746	--	611,466	563,154	13,020,767	7,216,616	1,066,366
Massachusetts	7,484,613	3,011,966	3,073,049	163,762	7,246	3,400,092	38,746	--	--	--	2,634,013	213,039	626,000
Michigan	42,666,677	10,210,623	32,362,764	469,736	466,606	6,143,442	66,140	--	--	--	20,742,264	10,300,000	1,712,600
Micronesia	1,213,412	669,412	300,000	22,526	--	670,884	--	--	--	--	126,000	123,000	72,000
Minnesota	40,184,859	6,372,641	20,622,016	448,594	969,636	6,162,735	46,664	--	--	--	16,666,646	6,054,061	4,000,379
Mississippi	27,466,320	10,610,041	16,967,287	341,729	864,316	6,073,495	74,556	244,036	1,261,610	469,296	13,643,267	1,063,000	1,001,000
Missouri	38,471,701	12,200,074	21,371,627	437,316	406,616	6,616,000	60,116	306,415	1,012,072	200,000	16,356,767	3,364,661	2,678,399
Montana	6,416,723	3,766,736	3,666,067	123,073	106,766	2,476,677	63,696	--	--	--	3,050,020	2,627,766	661,200
Nebraska	26,631,012	3,763,146	21,036,766	266,300	340,242	4,790,434	38,746	306,415	--	--	13,300,146	6,162,762	1,674,666
Nevada	6,204,162	1,336,969	6,904,103	56,424	66,606	1,166,290	38,746	--	--	--	3,646,003	3,016,166	--
New Hampshire	3,773,312	1,765,669	4,969,450	62,177	74,936	1,666,113	38,746	--	--	--	2,431,660	1,627,246	630,522
New Jersey	16,300,706	3,663,601	11,422,144	167,146	166,668	3,464,716	38,746	--	--	--	6,966,000	4,436,144	--
New Mexico	10,241,346	3,662,603	7,046,743	111,634	162,646	2,273,663	44,070	--	--	--	5,756,160	1,663,643	200,000
New York	66,777,969	11,607,626	63,070,066	666,117	430,366	10,642,040	76,372	--	--	--	11,166,141	24,636,775	17,642,162
North Carolina	60,676,634	16,647,634	43,626,360	642,363	611,660	13,262,626	64,166	--	2,266,565	469,296	27,770,034	16,466,366	666,000
North Dakota	12,626,222	4,062,663	3,762,700	163,467	160,064	3,426,666	38,746	273,360	--	--	5,652,700	2,125,000	666,000
Northern Marianas	766,640	766,640	--	26,477	--	776,460	--	--	--	--	--	--	--
Ohio	41,046,262	11,626,667	29,220,666	674,074	106,121	11,060,600	52,000	--	--	--	15,243,432	12,162,601	1,764,632
Oklahoma	36,647,360	6,261,046	16,766,533	306,224	330,462	6,661,660	38,746	313,140	1,144,626	469,296	16,201,523	3,473,000	1,112,000
Oregon	21,306,676	4,261,172	17,047,600	306,461	321,116	3,653,604	60,077	--	--	--	13,676,700	3,146,000	29,100
Pennsylvania	62,621,637	13,271,627	30,250,000	601,461	166,666	11,641,616	77,767	--	--	--	13,666,000	6,400,000	--
Puerto Rico	16,062,667	7,766,775	7,307,112	206,623	116,636	7,666,714	--	--	--	--	6,466,666	761,666	46,632
Rhode Island	2,666,165	1,312,066	1,266,015	42,616	11,470	1,216,966	38,746	--	--	--	1,126,530	136,466	20,000
South Carolina	20,516,666	6,102,063	21,417,463	300,746	366,641	3,366,332	63,326	--	1,111,660	630,425	16,266,617	1,627,666	623,117
South Dakota	6,776,276	3,666,151	6,104,126	162,666	106,226	3,350,522	38,746	--	--	--	4,662,125	667,000	136,000
Tennessee	33,964,001	13,769,642	21,044,350	466,324	644,339	6,521,969	64,930	--	1,726,756	564,260	16,563,004	4,527,863	163,500
Texas	70,969,229	16,661,121	51,096,106	660,602	1,066,909	14,665,299	93,781	--	2,346,393	643,153	36,662,109	13,750,000	466,000
Utah	6,966,444	3,023,224	7,930,220	92,136	110,649	1,792,300	38,746	--	--	--	6,715,000	1,505,863	209,395
Vermont	5,368,094	3,044,699	3,323,195	75,016	64,355	1,704,950	38,746	142,006	--	--	3,323,195	--	--
Virgin Islands	1,437,632	946,325	869,207	21,942	3,111	930,372	--	--	--	--	862,207	--	--
Virginia	48,117,372	11,120,201	36,697,171	414,736	616,673	7,629,715	78,183	--	1,457,332	624,284	20,041,631	10,730,540	225,000
Washington	32,384,221	4,701,090	17,669,131	235,466	277,837	4,206,741	72,663	--	--	--	10,969,706	6,466,929	1,103,500
West Virginia	13,533,324	4,822,116	7,711,206	166,380	166,265	4,408,211	56,300	--	--	--	4,416,153	2,306,924	986,229
Wisconsin	43,395,474	8,201,820	34,060,654	469,672	427,609	6,742,624	61,731	--	--	--	20,029,704	12,990,241	1,070,709
Wyoming	6,640,293	1,677,066	4,663,177	73,571	74,084	1,490,976	38,746	--	--	--	3,374,076	1,966,109	--
Unallotted 1]	38,466,369	38,466,369	--	--	--	38,466,369	--	--	--	--	--	--	--
GRAND TOTAL	$1,996,909,441	$401,167,430	$984,699,011	$16,453,000	$16,269,000	$332,420,630	$2,749,520	$2,446,000	$25,740,600	$9,127,960	$851,069,083	$367,269,630	$65,717,316
Dist. of Columbia 2/	2,267,077	969,600	969,600	--	--	969,000	--	--	--	--	963,000	--	--

1] This includes $527,126 available for Special Need Projects, $500,000 for Integrated Pest Management Projects, $1,402,600 for Pesticide Impact Assessment Projects, $1,360,000 for Farmers With Disabilities Projects, $1,360,000 for Food Safety and Quality Projects, $1,360,000 for Indian Reservation Projects, $6,200,000 for Youth At Risk Projects, $10,021,330 for Water Quality Projects, $1,123,320 for Agricultural Telecommunications Projects, $3,900,000 for the Federal Employees Retirement System (FERS), and $6,042,020 for Congressionally earmarked projects

2] District of Columbia Public Postsecondary Education Reorganization Act

RURAL CRISIS RECOVERY PROGRAM

Mr. DURBIN. Under the breakout for funds from Federal sources is a column titled Rural Crisis Recovery Program. Would you explain to the Committee what this is?

Dr. JOHNSRUD. The Rural Crisis Recovery Program refers to the Dislocated Farmers Assistance Grants which are provided to eight States, specified by Congress to assist farmers to remain in agriculture.

Mr. DURBIN. Funds from the Extension Service, the Agricultural Stabilization and Conservation Service, the Farmers Home Administration, the National Agricultural Statistics Service, and the Soil Conservation Service were used to establish a pilot program at North Dakota University in support of a Native American Scholars Program. The purpose of this project is to attract and prepare Native Americans for agricultural careers in USDA and Land-Grant universities. What is the total amount of funds devoted to this program and how is it working?

Dr. JOHNSRUD. Unfortunately, this program did not get established as proposed. The funds from the other USDA agencies were returned to the agencies and no Federal funding was provided to North Dakota State University. There was an inadequate number of applicants in order to make the program viable within the state.

PLANETOR

Mr. DURBIN. PLANETOR is a microcomputer system designed to help farmer's identify and study the environmental and economic impacts of their management decisions. Where do farmers go to access this system?

Dr. JOHNSRUD. The initial version of PLANETOR has been distributed to farm management and other agricultural specialists and agents. Farmers have access to this initial version through these Extension staffs. One hundred and thirty professionals from the Land-Grant Universities in 40 States and the U.S. Department of Agriculture have attended PLANETOR training sessions. Each of these Extension professionals are working with groups of farmers using PLANETOR and collecting suggestions for improvements. Fourteen States are active users of PLANETOR, 17 States are in the process of becoming active users, and additional States have inquired about PLANETOR and have received information on procedures for becoming active users. Improvements are currently under consideration for PLANETOR relative to nutrient and pesticide movements in soil, wind, and water erosion; toxicity levels of specific chemicals; impacts of tillage systems; and irrigation and other field specific applications.

Mr. DURBIN. How many farmers used this system in fiscal years 1991 and 1992?

Dr. JOHNSRUD. Farmers in approximately ⅔ of the States are aware of PLANETOR. Based on preliminary data, approximately 175 and 300 farmers, respectively, used PLANETOR in fiscal years 1991 and 1992. The data also indicates numerous other farmers are investigating the use of PLANETOR. Based on farmer input into an improved version, more complete users of PLANETOR is expected to occur when this versions, now being developed, is completed.

Mr. DURBIN. Funding for PLANETOR in 1991 was $300,000. What was the funding level for 1992?

Dr. JOHNSRUD. The Cooperative State Research Service (CSRS) allocated $100,000 of Sustainable Agriculture Research and Education (SARE) funding to support improvements in PLANETOR in 1992.

INTERNATIONAL PROGRAMS

Mr. DURBIN. How many Extension agents do you have assigned overseas, where are they, and what are they doing in these countries?

Dr. JOHNSRUD. At this time we have 20 Extension agents on overseas assignments—14 in Poland, 2 in Armenia, 1 in Russia, 2 in Honduras and 1 in Panama. Thirteen additional agents were scheduled to begin overseas assignments in March—7 in Bulgaria, 3 in Russia, and 3 in Armenia. In Eastern Europe and the former Soviet Union, Extension is supporting U.S. efforts to assist these countries in their transition to political democracy and a market economy. We are working with Ministries of Agriculture and other agricultural institutions in these countries to develop their capacity to deliver client-oriented, practical education programs to private farmers, newly emerging agribusinesses and rural communities. This includes enabling these institutions to deliver economic education programs that provide farmers and agribusinesses with the skills necessary to operate successfully in a market economy. We are also providing public policy advice to Ministries of Agriculture and legislative bodies in these countries as they develop laws and policies governing the privatization of their agricultural sectors. Finally, we are assisting a small farm community near St. Petersburg to move through the privatization process. In Latin America we are assisting A.I.D. Missions in projects to strengthen farmer cooperatives and to promote environmentally sound, sustainable agricultural practices.

In addition to supporting U.S. foreign policy goals, we believe that the experience gained by these agents on overseas assignments is invaluable in providing our clientele in the United States with skills and knowledge that will enable them to live and complete successfully in the global economy.

FAMILY LIFE ENRICHMENT

Mr. DURBIN. You received funding in fiscal year 1992 from the U.S. Army for Family Life Enrichment to revise and update educational materials to help military personnel and their families deal with deployment and reunion as a result of Desert Storm. Are you receiving any additional funding in fiscal year 1993?

Dr. JOHNSRUD. In 1993, Extension received $320,000 in additional funding from the U.S. Army for 2 projects initiated in 1992 to support programs for military personnel and their families. Funds are "Operation Ready" for the development of educational materials to help military personnel and their families be better prepared to deal with issues related to deployment, relocation and transition to civilian life. Target populations include family support groups,

family assistance, center program staff, military leaders and family members.

This and other programs focus on the development of education materials and training related to personal and family financial management, child abuse prevention, parenting and nutrition as well as relocation and transition to civilian life.

WORKPLACE ENHANCEMENT

Mr. DURBIN. What is the status of the Work Place Enhancement Program, a five-year plan to implement an interagency electronic data and computer system?

Dr. JOHNSRUD. The multi-year interagency Work Place Enhancement Program is virtually complete. In addition to installing an agency wide state-of-the-art local area network and putting more than 200 personal workstations on the desktops of ES–USDA staff, we have successfully networked those computers on the Internet, the global interconnected network of networks.

The complete penetration of the internet throughout the land grant system and the 70% complete penetration of the internet to county offices has greatly improved connectively and timely data collection and delivery on a nationwide basis. The CES approach is based on open systems, use of internationally accepted standards, and collaborative work through networking. ES works very closely with the National Science Foundation and is coordinating all efforts with the Federal Networking Council. Information management decision making today is far easier given that the global internet is the infrastructure for communicating not only with state and local levels, but many other countries as well.

We are excited about our increasing ability to connect, communicate, and manage in a dynamic and collaborative, rather than static sense. ES can gain access to nearly any database that is open within USDA, within the land grant community, in other countries, and in other government agencies virtually instantaneously. Software has been developed that enables end users to access and retrieve electronic documents via electronic mail. Developed by one of our land-grant partners, this software (ALMANAC) is being deployed throughout CES and the Department.

The National Standards Management Committee is one way that ES is promoting "standard practices" for encoding of electronic documents, digital data file exchange via national networks, and archiving educational material in all media.

Open systems, interconnectivity and collaboration are the watchwords that govern ES sharing with other agencies. ES currently provides and maintains access to the internet for the science and education community within USDA. Other USDA agencies have benefitted from the Extension Service in establishing and promoting internet usage for USDA scientist and educators.

Open systems and interoperability are the keys to our continued success with the Work Place Enhancement Program and will provide maximum flexibility for the integration and facilitation of global, internet worked informational resources.

SMITH-LEVER FUNDS

Mr. DURBIN. Please update the table that appears on page 557 of last year's hearing record showing the amount requested and the amount appropriated for the basic formula funds and Smith-Lever to include fiscal year 1993?

Dr. JOHNSRUD. I will be happy to.

[The information follows:]

SMITH-LEVER 3(b)&(c) FUNDS

[Dollars in thousands]

	Presidents budget	Actual appropriation
1983	$219,376	$230,376
1984	230,376	234,984
1985	241,484	241,484
1986	241,484	229,713
1987	127,547	236,213
1988	237,594	241,594
1989	228,483	241,594
1990	241,594	242,272
1991	246,535	252,608
1992	262,100	262,712
1993	262,712	262,712

EFNEP

Mr. DURBIN. Please update the table that appears on page 558 of last year's hearing record showing the budget request and the amount appropriated to include fiscal year 1993.

Dr. JOHNSRUD. I will provide the updated table for the record.

[The information follows:]

EFNEP

[Dollars in thousands]

	Presidents budget	Actual appropriation
1983	$60,354	$60,354
1984	34,821	60,354
1985	34,821	60,354
1986	-0-	57,635
1987	-0-	57,635
1988	-0-	58,635
1989	22,111	58,635
1990	21,600	58,197
1991	21,600	60,525
1992	58,635	60,525
1993	62,635	60,525

PEST MANAGEMENT

Mr. DURBIN. You have reported that for fiscal year 1992 the ratio of Federal funds appropriated for integrated pest management or IPM programs to grower payments for IPM services is nearly 1 to

5. In addition to this, state appropriations for IPM programs exceeded Federal appropriations by about 11 percent. Is this still the case for fiscal year 1993?

Dr. JOHNSRUD. The ratio of fiscal year 1992 Federal funds appropriated for Cooperative Extension System IPM programs compared to grower payments for IPM services provided by private agricultural consultants and grower-operated crop management associations was estimated to be nearly 1:5 at last year's hearing. Based on our analysis of state reports for fiscal year 1992, grower payments for IPM services was $34.6 million. The fiscal year 1992 Federal expenditure for CES IPM programs was $8.1 million, or 23 percent of grower payments; thus the actual ratio is approximately 1:4. This means that IPM services are important enough to growers that on average they spend more than $4 to obtain services for every Federal dollar appropriated for Extension IPM programs. In fiscal year 1992, state appropriations for Extension IPM programs was approximately $9.3 million—approximately 13 percent more than the Federal appropriation for Extension's IPM programs. Annual reports for fiscal 1993 IPM programs have not yet been submitted, but we expect that these ratios will remain approximately the same for the current fiscal year.

Mr. DURBIN. What pesticide impact assessments were completed in fiscal year 1992 and what assessments are currently underway?

Dr. JOHNSRUD. Three pesticide impact assessments were completed in fiscal year 1992: atrazine, methyl bromide, and propoxur. Pesticide impact assessments are currently underway for the following chemicals, crops, and other uses: 2,4-D; chlorpyrifos; diazinon; propargite; alfalfa; citrus; cotton; cranberry; green leafy vegetables; corn and soybean systems; corn planting-time insecticides cluster analysis; peanut; rice; sorghum; and grain storage, milling, and warehouse facilities.

Mr. DURBIN. Completed pesticide impact assessments are sent to EPA. What does EPA do with this information?

Dr. JOHNSRUD. The pesticide impact assessments produced by NAPIAP are transmitted to EPA upon completion. These documents provide EPA with a scientific analysis of economic benefits that can be used in the regulatory decisionmaking process. The USDA/ES/NAPIAP assessment process addresses only the economic benefits of pesticide usage to producers, processors, and consumers. The risk component related to pesticide usage is developed by EPA. In the regulatory decisionmaking process, EPA then attempts to balance the risk component with the benefit component.

Mr. DURBIN. Integrated pest management and cotton pest management are two components of the Pest Management Program. Why is cotton a separate program?

Dr. JOHNSRUD. A separate program for cotton is required because of the severity of yield losses caused by the boll weevil and other cotton pests and the tremendous economic impact of these losses to rural communities in the South. The severity of losses caused by cotton pests may result in extremely high rates of pesticide use on infested fields if conventional chemically-dependent pest management tactics are used. The Cotton Pest Management Program permits Extension to develop and deliver extension education programs to cotton farmers, grower organizations, independent crop

consultants, and other end-users. The programs supported with these Federal funds provide cotton farmers with an effective, economical, and environmentally sound pest management strategy to use on their farms.

FARM SAFETY

Mr. DURBIN. In fiscal year 1992, $2,470,000 was appropriated for the Farm Safety program. Of this amount, $970,000 was used to partially fund a farm safety specialist in each of the 50 States and Puerto Rico whose job is to educate farmers and their families on how to prevent farm accidents and reduce their exposure to occupational health hazards. Is this the same amount currently being used in fiscal year 1993 for these specialists?

Dr. JOHNSRUD. Yes. The $970,000 has been provided to all States and Puerto Rico to continue this aspect of the program.

Mr. DURBIN. The fiscal year 1993 appropriation included $2,000,000 for payments for rural health and safety education. Are these funds being used by these specialists?

Dr. JOHNSRUD. No. The $2 million Rural Health and Safety appropriation is being used to establish programs addressing rural health care issues with Mississippi State University Cooperative Extension Service and the Mississippi Community College foundation.

Mr. DURBIN. The remaining $1,500,000 of the 1992 appropriation for the Farm Safety program was used to fund state projects as well as a national grant to support an education and assistance program for farmers with disabilities. Would you provide the Committee with a brief description of each project, as well as the amount allocated to each?

Dr. JOHNSRUD. Funding was awarded to state projects in fiscal year 1992 to projects in Illinois, Indiana, Iowa, Louisiana, Michigan, Minnesota, New York, North Dakota, South Carolina, Wisconsin, and regional projects serving Vermont/New Hampshire, Montana/Idaho. The national project was awarded to Purdue University and the National Easter Seal Society. I will provide brief project descriptions for fiscal year 1992 for the record.

[The information follows:]

Brief Project Descriptions
Fiscal Year 1992

NATIONAL PROJECT
($164,381)

The project is designed to provide support for the participating state-level AgrAbility Projects (education and assistance program for farmers with disabilities) and carry out national activities related to the National AgrAbility Project which was authorized by Congress in the 1990 Farm Bill. This will include efforts to develop greater public awareness concerning the needs of farmers with disabilities and encourage the development or enhancement of service delivery programs not receiving funding from this program. Specifically, the goals of this project are:

1. Provide training for the state-level AgrAbility Projects that will ensure the successful development of service delivery programs designed to provide education and technical assistance to individuals with disabilities who are engaged in agriculture.

2. Provide technical assistance to the state-level AgrAbility Projects, other state Cooperative Extension Service Staff and cooperating non-profit disability organizations on assistive technology, agricultural worksite modifications, independent living techniques and service delivery strategies to enhance the quality of life and productivity of individuals with disabilities who are engaged in agricultural production and related occupations.

3. Carry out information dissemination and public awareness activities related to the National AgrAbility Project and disability issues affecting individuals engaged in agricultural production, related occupations and who live in rural communities.

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ILLINOIS
($96,560)

The University of Illinois Cooperative Extension Service and the Illinois Easter Seal Society will work cooperatively in the development of a long term system that will be designed to assist farmers and farm workers with disabilities and their families in the State of Illinois.

The two major objectives of the project are:

1. To establish in the State of Illinois a program to assist disabled farmers and their families in maintaining an adequate level of self-sufficiency by assisting them to maintain their farming occupation or develop a new career path, if the disability and economics warrant a change.

2. To develop a program to assist disabled farmers that will network and build on existing services and using state, volunteer, private and third party resources, to achieve a level of self-sufficiency.

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INDIANA

($105,302)

The Disabled Farmer Assistance project is designed to expand and enhance a unique partnership that has existed for the past 3 years between Purdue University and the Indiana Easter Seal Society for the purpose of providing specialized rehabilitation services to Indiana's farm and rural families who have been impacted by physical disabilities and to increase the public's awareness concerning disability issues in rural areas.

The project is coordinated by the staff of the Breaking New Ground (BNG) Outreach Program, located in the Department of Agricultural Engineering at Purdue, and is associated with the BNG Resource Center (an internationally recognized source of information and services related to assistive technology appropriate for agricultural workplaces.)

The Outreach Program will carry out the day-to-day activities of the project. The Indiana Easter Seal Society will be subcontracted to provide adjunctive services.

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IOWA

($130,640)

"Innovations that Work for Home and Farm" is a joint effort of Iowa State University Extension and the Farm Family Rehabilitation Management (FaRM) Program of the Easter Seal Society of Iowa, Inc., to help disabled Iowans remain in farming. Target audiences are farm families affected by disabilities, service providers, and volunteers committed to assisting those families. Project objectives are to: increase awareness of appropriate assistive technologies and services; demonstrate low-cost farm and home modifications; identify farm families obtaining modifications; provide direct services and technical assistance to make modifications; and train agency professionals and community volunteers. Project objectives will be accomplished through four key components: (1) awareness events and activities, (2) model farm and home makeovers with field days, (3) direct education and technical assistance, and (4) production of educational materials.

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LOUISIANA
($90,880)

This project is a cooperative effort of the Cooperative Extension Service, Easter Seals of Louisiana, Louisiana Vocational Rehabilitation Services, other agencies and volunteers throughout the state with the purpose of assisting members of the target population to overcome the barriers they face. This project will assist this targeted population to remain in farming through helping them overcome the barriers formed by their disability. This will be accomplished through on site information/education, problem solving, assistance in modifying living space, farm machinery and equipment, support and counseling from peers, and other methods based upon individual need. If staff or volunteers are unable to develop what is needed due to lack of expertise or funding, then individuals will be referred to the appropriate agency for services (i.e., vocational rehabilitation, rural health care provider, etc.) and project staff will provide case management and follow up.

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MICHIGAN
($85,000)

Five Michigan counties are involved in a pilot project with a goal of returning 50 or more disabled farmers, farm workers and their families to farming, the community and to independent living. Michigan State University's Cooperative Extension Service, through the Agricultural Engineering Ag Safety Program, will form a partnership with the Easter Seal Society of Michigan to create the Michigan Farm Family Rehabilitation Management program (MI-FaRM). MI-FaRM will establish a community based network to assist farmers and their families with on-the-farm rehabilitation services. The only qualifier for farmers is that they have a disability. MI-FaRM will employ a rural rehabilitation specialist to work with farm families needing rehabilitation services. An existing program with the Easter Seal Society and the Michigan Farm Bureau, the Michigan Farm Rehabilitation Management program, will be enhanced with this pilot program.

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MINNESOTA
($85,000)

Minnesota AgrAbility Project (MAP) provides education, on-site technical assistance, and resource information to consumers with disability living or working on farms and rural service providers through numerous channels. MAP involves program activities conducted by the Minnesota Extension Service, Goodwill Easter Seal Society of Minnesota, and Rural Rehab Technology.

Main program components include: a workshop (REACH - Resources and Empowerment for AgrAbility Leaders Close to Home) providing community-based extension agent/consumer teams with leadership and assistive technology skills and a funding mechanism to support local outreach activities; assistive technology assistance through on-farm visits, exhibits at large multi-state agricultural events, a toll-free information and referral hotline, and a free equipment loan program; awareness activities including presentations and networking with statewide disability organizations; expansion and facilitating access to an existing assistive technology resource center; and development and training of a peer technology support network to enhance MAP outreach capabilities.

MONTANA/IDAHO
($122,889)

The mission of the EIEIO Project is to ensure that persons with disabilities who are engaged in farming, ranching or related activities and who live in Montana, Wyoming and Idaho will be provided education and technical assistance directed at accommodating their disability and thereby maximizing their productivity and independence. Principal activities of the EIEIO Project are (1) to implement and sustain a networking coalition of rehab and agricultural professionals; (2) to provide awareness of and information/referral on assistive technology and rehabilitation resources to farmers/ranchers and their families; (3) to provide on-the-farm technical assistance; (4) to provide enhanced utilization of community-based volunteer resources in delivering rehabilitation services; and (5) to provide training on assistive technology and rehabilitation resources to rural ag, vocational, rehabilitation and health care professionals.

Project participants include the Extension Services of Montana and Idaho; Easter Seal of Montana and Idaho and the Research and Training Center on Rehabilitation Services at Montana State University and at the University of Montana.

NEW YORK
($96,560)

Farm safety, health, accident prevention, and disability are all facets of the same community-wide issue. Each year there are close to 1,000 new permanently disabled individuals on New York State farms. Young farm workers and family members are especially at risk of injury. FarmAbility, a cooperative program of Cornell Cooperative Extension and the New York Easter Seal Society will develop replicable region-wide community-based services to ensure that farm safety and disability education, information and referral services, technical assistance, and on-the-farm habilitation and rehabilitation services will be available to New York State farmers, farm workers, and their families. A flexible, community development model will be used to meet the needs of individual counties.

Working with county Extension staff, FarmAbility staff will act as a catalyst to build community-based services by organizing a local task force of appropriate agencies and organizations and by training the task force in each county to continue providing services after the initial year of contact. The rural rehabilitation staff will provide rehabilitation services in all counties that are involved in the program.

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NORTH DAKOTA
($85,000)

Easter Seal Society of North Dakota (ESSND) in cooperation with the North Dakota State University Extension Service (NDSUES) are initiating the Education and Assistance Program for farmers with Disabilities. The North Dakota AgrAbility Project will assist North Dakota residents with disabilities who engage in agriculture farming, ranching, agriculture work, related occupations, and their families, to safely accommodate disability in agriculture and rural living. The North Dakota AgrAbility Project will be providing services to 22 counties in the Eastern Region of North Dakota. In the second year, the North Dakota AgrAbility Project will expand the services to include the Central Region of North Dakota. In a 3-year process, the North Dakota AgrAbility Project will be providing services to the entire state of North Dakota.

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SOUTH CAROLINA
($85,000)

The Education and Assistance Program for Farmers with Disabilities provides education and technical assistance to farmers, farm workers, and farm family members in South Carolina. The program will be conducted cooperatively by the Clemson University Cooperative Extension Service (CES) and the South Carolina Disabilities Research Commission (DRC). The South Carolina Disabled Farmer Consortium, made up of representatives from CES, DRC, S.C. Easter Seals, and the S.C. Vocational Rehabilitation Department, will guide the project. In addition to providing education and technical assistance to disabled individuals, the program will educate and train Extension agents and rehabilitation and health care professionals. A public information campaign will be conducted to raise community awareness.

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VERMONT/NEW HAMPSHIRE
($124,868)

For more than 22 years, the Rural & Farm Family Vocational Rehabilitation Program (RFFVRP) has been an integral part of both the University of Vermont's Extension Service and the Vermont Division of Vocational Rehabilitation Service delivery system. Under USDA Extension Service funding, the RFFVRP will be expanding and enhancing its current service delivery capacity.

Through program enhancement RFFVRP will be able to remove the feeling of isolation often experienced by rural families in time of crisis; provide the rural communities the opportunity to become actively involved in meaningful service activity; and above all enhance the capacity to provide face-to-face counseling to the people served by the program.

WISCONSIN
($107,920)

The Resource Center for Farmers with Disabilities was developed by the Easter Seal Society of Wisconsin, Inc., to enhance the services for individuals with disabilities in the agricultural setting. The involvement of the University of Wisconsin Cooperative Extension Service will strengthen the program through providing educational programs, assisting with technical support, and developing programming at the community level. To many farming is not just a business but a lifestyle. The greatest impact will be on the individual with the disability but the whole family and agricultural industry will benefit. RCFD is able to serve throughout the state and individuals from ages 1-90. Service may be as easy as making contact with another service agency or as complicated as developing a modification for a piece of agricultural equipment.

Quality of life is important to everyone. Providing the assistive technology, education and family support to allow a farmer with a disability to continue to farm will be the focus of the program.

FARM SAFETY

Mr. DURBIN. Are any of these projects funded in fiscal year 1993 and are any additional projects being initiated?

Dr. JOHNSRUD. All projects funded in fiscal year 1992 are being funded in fiscal year 1993. We anticipate that two of the new projects currently under review will be funded in fiscal year 1993.

Mr. DURBIN. Also, provide for the record some specific projects that are ongoing in cooperation with the National Easter Seal Society to provide programs to disabled farmers and farm workers.

Dr. JOHNSRUD. Some specific projects in cooperation with the National Easter Seal Society are: Semi-annual educational workshops for continuing and new state-level AgrAbility Projects; On-site training and public awareness activities in states with AgrAbility Projects; On-going technical assistance including programmatic information, case specific consultation, referral to appropriate information source, research and followup on topics of concern for each of the state-level AgrAbility Projects. State-level AgrAbility projects are also working in conjunction with state affiliates of the National Easter Seal Society as indicated in the brief project descriptions provided.

Mr. DURBIN. Congress provided the farm safety program with an additional $250,000 in fiscal year 1993. How are these funds being used?

Dr. JOHNSRUD. These funds are being used to fund two new projects and provide a 4 percent increase in funding to projects funded in fiscal year 1992.

Mr. DURBIN. Please update the table that appears on page 564 of last's hearing record showing the budget request for the Farm Safety program and the amount appropriated, by year, for each of the last 10 years, to include 1993.

Dr. JOHNSRUD. I will provide the information for the record.

[The information follows:]

FARM SAFETY

[Dollars in thousands]

	President's budget	Actual appropriation
1983	0	$1,020
1984	0	1,020
1985	0	1,020
1986	0	970
1987	0	970
1988	0	970
1989	0	970
1990	0	963
1991	0	1,970
1992	0	1,470
1993	$1,000	2,720

RURAL DEVELOPMENT CENTERS

Mr. DURBIN. Please update for the record the table which appears on page 566 of last year's hearing record, indicating how

each of the Rural Development Centers allocated their funds in fiscal years 1990, 1991, and 1992, to include fiscal year 1993.

Dr. JOHNSRUD. I will update that table for the record.

[The information follows:]

	Fiscal year—			
	1990	1991	1992	1993
North Central Regional Center for Rural Development:				
Personnel	$58,000	$62,998	$72,998	$71,247
Travel and subsistence	49,000	47,000	42,000	6,000
Publications (educational materials)	63,647	63,000	58,000	15,000
Current expense (supplies, eqpt.)	16,000	15,000	15,000	7,800
Subcontracts and agreements with other institutions				89,243
Computer	1,290	1,300	1,300	
Total	187,937	189,298	189,298	189,290
North Dakota Institute for Business and Industry Development:				
Personnel	133,676	170,376	170,016	182,400
Publication/printing costs		6,032	6,392	
Other costs	47,416	6,000	6,000	
Total	181,092	182,408	182,408	182,400
Northeast Regional Center for Rural Development:				
Personnel	43,000	54,600	53,900	89,889
Travel	14,647	15,000	15,000	15,401
Equipment and supplies	8,000	8,000	8,000	8,000
Center-funded projects	122,290	111,698	112,398	60,000
Publication/printing costs				16,000
Total	187,937	189,298	189,298	189,290
Southern Rural Development Center:				
Personnel	82,375	82,946	82,946	90,494
Travel	18,000	18,000	25,000	25,000
Other (fringe benefits)	19,770	19,770	18,248	27,148
Materials and supplies	12,051	11,488	15,000	20,000
Contractual	55,741	57,094	48,104	26,648
Total	187,937	189,298	189,298	189,290
Western Rural Development Center:				
Personnel	90,927	94,161	133,242	150,973
Travel (staff)	14,000	14,000	7,000	7,000
Office expenses and publications		15,000	7,000	5,000
Equipment and other expenses	16,500			
Other operating expenses (seed, CAP, and ACT projects)	66,510	66,137	42,056	26,317
Total	187,927	189,298	189,298	189,290

Mr. DURBIN. Specifically how do the Rural Development Centers improve the social and economic well-being of rural communities?

Dr. JOHNSRUD. The four Regional Rural Development Centers support and strengthen individual state efforts in rural areas by developing networks of university scientists and Extension faculty from a variety of disciplines to address rural issues. Strategies for dealing with those issues are developed by leaders across the region and the nation and are shared with rural communities.

For instance, an infrastructure task force was organized in an Oklahoma county as part of a Southern RD Center project to encourage creation of cost-efficient delivery systems and new methods

of delivering services. An outstanding example of its success was the creation of a first-responder system in Ellis County designed to equip volunteers in rural areas to respond to an emergency at the same time the ambulance was dispatched. They were strategically placed to arrive ahead of the ambulance. Shortly after the system was operational, an emergency room physician in the county hospital credited first-responders with saving the lives of two girls injured in an accident. Trained first-responders were on the scene 15 minutes before the ambulance arrived and restored the girls' breathing after their air passages had been blocked.

A University of Alaska Extension worker learned how to conduct an economic leakage survey and analysis using formulas for trade area analysis through a network developed by the Western RD Center. The instrument developed established the need for, and viability of, a cooperative grocery store in the Levelock area. Once funded and built, the cooperative recorded $200,000 in sales from the first year's operation.

WATER QUALITY

Mr. DURBIN. During 1990 and 1991, 16 demonstration projects were initiated to demonstrate the effectiveness of selected agricultural production practices in treating non-source pollution problems. Would you bring us up to date as to the status of each of these projects and if any are complete, what were the results?

Dr. JOHNSRUD. Each of the demonstration projects is a continuing effort. None have been completed yet. Very preliminary information indicates the potential for some quite promising results. A brief summary of each of the projects will be provided for the record.

[The information follows:]

ARKANSAS
Millwood Lake Watershed

This project focuses on agricultural activities in 5 counties in the watershed of a multipurpose lake. Proper disposal and utilization of animal waste, and assisting rural residents in protecting groundwater used for drinking water and maintaining on-site wastewater management systems are project objectives.

CALIFORNIA
Sacramento River Rice Water Quality

A major concern in rice production is the interaction of rice water management practices and herbicide applications. This project has developed demonstration sites for alternative water management systems, and is assisting producers to evaluate and adopt water management practices to reduce rice pesticide loadings to the Sacramento River.

COLORADO
San Luis Valley

Concern exists about excessive amounts of nitrogen from fertilizer leaking into groundwater through poorly timed and/or poorly distributed irrigation. A comprehensive education and technical assistance program has been implemented, including a domestic water quality education program for low income families.

FLORIDA
Lake Manatee Watershed

This project is helping vegetable and citrus producers adjust their production practices to help address public concern about potential contamination of a water supply reservoir by nutrients and pesticides. New water management systems also have been demonstrated and are being adopted by producers.

GEORGIA
Gum Creek Watershed

This watershed is located in a significant groundwater recharge area and is intensively farmed with diverse crops. Many federal, state and local organizations are collaborating in an intensive educational and technical assistance program to increase the adoption of BMPs to reduce nitrate and pesticide leaching.

IDAHO
Snake River Plain

Over 40 major crops are produced in this 8 county area under irrigation and intensive chemical management. Organizations are cooperating in the demonstration and acceleration of the adoption of BMPs, integrated crop management, integrated pest management, and improved crop water use efficiency.

IOWA
Northeast Iowa River Basins

This watershed has intensive crop and animal production, no large urban centers but a large tourism factor due to the presence of cold water trout streams. Project objectives include accelerating the adoption of on-farm management practices (BMPs), implementing assistance in integrated crop management, animal waste management, sediment control, and maintenance of water well structures.

MARYLAND
Monocacy River Watershed

The principal sources of NPS pollution in this part of the Chesapeake Bay drainage are livestock operations, septic systems, and soil erosion. A comprehensive program has been implemented to encourage the adoption of BMPs and IPM, an integrated systems approach to farming to reduce agricultural chemical and nutrient loadings to surface and groundwater, and to educate rural residents about well testing and wellhead protection.

MICHIGAN
Saginaw Bay

A variety of agricultural operations exist in this area including row crops, vegetables, hay, dairy, beef, and swine. Organizations are working together to promote a systems approach to farming, promote erosion control, safe pesticide storage and handling, and improved irrigation practices.

MINNESOTA
Anoka Sand Plain

This 11-county area produces a variety of crops and livestock. The specific goal of the project is to encourage the use of BMPs and the adoption of management practices to reduce groundwater contamination potential. Specific programs focus on nutrient management, integrated pest management, erosion control, water management, and wellhead protection.

NEBRASKA
Mid-Nebraska Demonstration Project

This 15-county area has been irrigated for more than 30 years. Nitrate levels in the soil and groundwater have risen due to use of fertilizer and poor irrigation management. The demonstration project fosters the adoption of management practices to reduce nutrient and pesticide loadings,and to provide adequate moisture to crops while reducing agrichemical leaching.

NEW YORK
Wallkill-Rondout Demonstration Project

An integrated education and technical assistance effort promotes the adoption of BMPs in vegetable, fruit and ornamental production, sod farming, nurseries and greenhouses, and dairy, beef and swine operations. Demonstration areas have been established for IPM, irrigation, animal waste management and proper pesticide storage and disposal.

NORTH CAROLINA
Herrings Marsh Run

There is concern in this area about nutrient and sediment input and pesticide leaching from poultry, swine, beef, corn, tobacco, cotton, wheat and vegetable production. Project objectives include increasing grower participation in ICM, and accelerating adoption of management practices to reduce contamination of ground and surface water.

SOUTH DAKOTA
Big Sioux Aquifer Demonstration Project

Crop and livestock production have contributed to an increase in bacteria and nitrate levels in domestic well samples. High nitrate levels in public water systems have necessitated developing new wells. This project is a collaborative effort to implement BMPs, wellhead protection practices including plugging of abandoned wells, promoting safe agricultural chemical storage, and improving animal waste management systems.

TEXAS
Seco Creek Demonstration Project

This project demonstrates cost-effective resource management systems, IPM, and efficient irrigation practices. Producers have adopted brush management practices, including burning substituted for herbicide use.

WISCONSIN
East River Demonstration Project

Organizations have implemented a collaborative education and technical assistance program to encourage improved land management practices to reduce pollution from dairy and hog operations. The project also focuses on improved design and management practices of farmstead structures and wells.

Mr. DURBIN. A total of 24 projects are included in the Department's Water Quality Plan. As I understand it, the eight remaining projects were deferred pending an assessment of the current projects and the availability of resources. What is the status of these projects?

Dr. JOHNSRUD. Your understanding is correct. The Department's Water Quality Plan does include 24 demonstration projects. Implementation of the final 8 demonstration projects continues to be pending based on the assessment.

YOUTH AT RISK

Mr. DURBIN. How many projects were funded under the Youth At Risk program in fiscal year 1992 and how many are proposed to be funded in fiscal year 1993?

Dr. JOHNSRUD. In fiscal year 1992, we extended funding to the 70 projects funded in fiscal year 1991 and funded 26 new projects. The fiscal year 1993 funds of $10 million will allow us to continue support to the 96 current projects.

Mr. DURBIN. For the record, please provide a list of all those funded in 1992 and those proposed for 1993.

Dr. JOHNSRUD. I will provide a list of projects funded in fiscal year 1991 and renewed in 1992. The staff are currently reviewing the renewal applications for fiscal year 1993. If possible, one new project may be funded in 1993. Our first priority is to support the existing projects for up to 5 years with a declining portion in the last two years. This is designed to give the community coalitions and the Cooperative Extension Service time to demonstrate effectiveness of the programs and gain new sources of funding for continuation.

[The information follows:]

FY 1991 FEDERALLY FUNDED PROJECTS

STATE	PROJECT TITLES
ALABAMA	Assess and Address: Meeting the needs of High Risk Youth
ALASKA	4-H Yukon River Fisheries Enhancement and Youth Development Program
ARIZONA	Phoenix Coalition for Youth and Families
ARKANSAS	"Sail"
CALIFORNIA	School Age Child Care Education
CONNECTICUT	Bridgeport R.I.S.E.
CONNECTICUT	New Haven Spaces Initiative
CONNECTICUT	School-Age Child Care in Hartford, Connecticut
DELAWARE	WCASA Community Partnership
DELAWARE	Seaford Collaboration for Youth

FLORIDA	Focus on the Future: Enhancing Literacy Through Technology Education and Career Exploration
GEORGIA	Project KITE
GUAM	Project Youth Empowerment **(DID NOT SUBMIT RENEWAL APPLICATION FOR--92)**
HAWAII	A.C.T.
IDAHO	After School Adventures and Mentoring Program
IDAHO	4-H Adventures Club
IDAHO	School Age Child Care and Parenting Resources
ILLINOIS	Youth At Risk School Age Child Care and Parent Education Program for Aledo, Sherrad and Westmer Unit School and Communities
ILLINOIS	Computer Assisted Learning
INDIANA	Space Station Indiana
IOWA	Model City/Woodland Willkie Literacy Project
IOWA	Community Parenting Coalition Targeting High Risk Youth
KANSAS	Caring and Collaborating for Youth: Kansas/Pottawatomie Co.
KANSAS	Responsive Educational Approach to Diversity
KENTUCKY	Literacy and Technological Literacy Priority Area--Harlan Youth Employability
LOUISIANA	Horizon Program
MAINE	Strategies Developing School Age Child Care and Education in Rural Maine
MARYLAND	4-H Adventure in Science
MASSACHUSETTS	YAR Programming in Worcester County

MICHIGAN	Literacy and Technological Literacy for Youth At Risk
MINNESOTA	Project FINE
MINNESOTA	Youth Issues Education
MISSISSIPPI	After School Child Care and Education
MISSOURI	4-H Summer Adventure Club
MISSOURI	The St. Joseph Youth Alliance: A Targeted Prevention/Intervention Coalition
MONTANA	Native American Family Empowerment Project
NEBRASKA	(13 Days - 13 Kids) Kids' Team-Coalition Building to Empower School-Aged Rural Children
NEVADA	Choices and Challenges for Youth
NEW HAMPSHIRE	Youth Opportunities Unlimited A Comprehensive School-Age Child Care Program
NEW JERSEY	Bergen-Lafayette Up-Scale Project for Youth Ages 5-14
NEW JERSEY	4-H After School Education in Newark Housing Complexes
NEW JERSEY	Camden City Community Garden Program Youth at Risk Gardening Project
NEW MEXICO	"From Roots to Wings" A Proposal for Quay County Youth Partnership-QCYP
NEW MEXICO	Prevention Leads Upward to Success (PLUS)-(**DID NOT SUBMIT RENEWAL APPLICATION FOR--92**)
NEW YORK	School's Out-School Age Child Care Program
NEW YORK	Make a difference Program for Youth
NEW YORK	Rural Families Cooperative/After School Child Care Program
NORTH CAROLINA	Wayne County 4-H High Risk Programming in an After School Setting
NORTH DAKOTA	The Rural School and Community Development Project

OHIO	Knox County After School Day-Care Program
OHIO	Athens County Coalition Enhancement Project
OHIO	Cleveland Peer Volunteer Development Coalition
OKLAHOMA	Coalition for After School Care for High Risk Indian Youth
OKLAHOMA	Home Visitation Program for Adolescent Mothers
OREGON	Kid Konnection
OREGON	Youth Development in the Timber-Dependant Community of Mill City-Gates
PENNSYLVANIA	Youth Extension Program-Chester County (Coatesville)
SOUTH DAKOTA	Youth at Risk Proposal "After School Child Care"
TEXAS	4-H CARES Project
TEXAS	Making the Grade: Victoria
TEXAS	(The Rutabaga Project) The OLE Project: 4-H School Age Literacy Education Program for Hispanic Youth
UTAH	Project CARES
VIRGINIA	Strong Families, Competent Kids/Caring Communities YAR Initiative
VIRGINIA	Science/Technological Literacy Education for High Risk Youth in Giles County
WASHINGTON	High Risk Youth Program - 4-H Challenge
WASHINGTON	Family Focus School Age Child Care Project
WEST VIRGINIA	Developing Youth Potential: Enabling Youth at Risk to Become Healthy Productive, Contributing Adults
WISCONSIN	Wisconsin Youth Futures
WYOMING	Healthy Infant-Capable Adolescent Project
WYOMING	Wind River Indian Reservation Youth and Family at Risk Project

FY 1992 NEW FEDERALLY FUNDED PROJECTS

STATE	PROJECT TITLES
ALASKA	Kuskokwim 4-H Fisheries and Youth Development Program
CALIFORNIA	Reading and Science Literacy for At-Risk Youth (SERIES)
CALIFORNIA	4-H AM/PM Club-Chula Vista
COLORADO	Roots and Wings: Redirecting Highest Risk Youth (**DID NOT SUBMIT RENEWAL APPLICATION FOR--93**)
CONNECTICUT	New Britain/Slade Middle School After School Program
GEORGIA	Calhoun/Gordon County Shuttle School
ILLINOIS	Youth at Risk School Age Child Care and Family Enrichment
IOWA	Postville Child Care--A Rural Model for Before and After
KANSAS	Kids After School: Reno County, Kansas
KENTUCKY	Garrard County Child Care Program
MICHIGAN	All for One: Pattengill Area Reading, Math, and Science
MICHIGAN	Say YES to Willow Run
MINNESOTA	On the Move...For Minnesota Families
MISSISSIPPI	4-H Project SOARS
MISSOURI	Students Taking Academic Initiative for Reading Success (STAIRS)
NEVADA	Building Communities of Support for High Risk Youth in Isolated Rural Nevada
OHIO	Community Councils for Youth at Risk-Clermont County
PUERTO RICO	Vieques Kids in Action for Science Education
RHODE ISLAND	R.I. CE School Age Child Care Education

SOUTH CAROLINA	CHOICES
SOUTH DAKOTA	Pine Ridge Youth Coalition and Center
TENNESSEE	4-H B.E.S.T.
TEXAS	Partnerships: ROPES
VERMONT	Enhancing Community Awareness
VIRGINIA	Bailey's Community "Making the Grade" Project of Fairfax
WASHINGTON	Salishan Together for At Risk Youth (STAR Youth)

Mr. DURBIN. How are projects chosen to participate in this program? What criteria or guidelines are used to select the best projects?

Dr. JOHNSRUD. Each State Cooperative Extension Service performs an application review process to identify the applications to be submitted to ES–USDA. Each application was reviewed by a team of expert reviewers. Each application was rated on its merit and awards were made to the highest rated applications.

Through a competitive proposal process, "communities" of up to 80,000 population from the most rural to highly urban will be identified as program sites. Community is defined in the broadest sense with the potential for "community" to be a number of sparsely populated rural counties or a portion of an inner city. Community shall not be geographically interpreted to be a statewide program or noncontiguous entities. Program sites must have significant need for Youth At Risk programming; "significant need" is defined in terms of risk factors or barriers to youth reaching their full potential. Need is significant when two or more risk factors interact. Risk factors include, but are not limited to, poverty; substance abuse; teen pregnancy; illiteracy; school dropouts; AIDS; and homeless youth.

The ES–USDA Review Panels use a set of criteria to recommend proposals for funding. These include:

Extent of cooperation expected from community-based organizations, the corporate sector, schools, agencies, and program recipients.

Degree to which the project is comprehensive and intensive so as to yield desired results.

Degree to which there is commitment to work with youth 5 to 14 years of age and their families.

Availability and competence of a culturally diverse faculty, professional, paraprofessional, and volunteer staff needed to carry out the project.

A budget that has no less than 80% of resources expended at the local level for client programs and services.

Evaluation plan that provides for impact measurement including feedback by youth participants, parents, and community collaborators.

Demonstrated commitment to equal employment opportunity.

Demonstrated commitment to staff development and training.

Interdisciplinary support from relevant colleges and departments.

Plan for utilizing the resources and technical assistance, provided by the Centers For Action funded by the Community CARES project.

Institutionalize Youth At Risk programming to insure program continuation beyond Federal funding and integration into the community and ongoing Cooperative Extension Service programming.

Identification of geographical areas where significant need has been identified.

ES–USDA conducts further review of the budget sections of the applications to insure compliance with department regulations. State Extension Services must be prepared to provide an adequate level of institutional support, adequate matching funds, and capacity to support and lead the number of projects funded.

Mr. DURBIN. How many applications did you receive in both fiscal years 1992 and 1993 and how many did you fund?

Dr. JOHNSRUD. In fiscal year 1991, we received 119 applications and funded 70. In fiscal year 1992, we had 82 new project applications and funded 26. We received 15 new applications in fiscal 1993. The first priority for 1993 funding is to renewing the current projects. As soon as the staff complete the process of reviewing the renewal applications we can determine if new projects can be funded.

CENTERS FOR ACTION

Mr. DURBIN. The six Centers for Action which provide nationwide technical assistance for the programs funded under Youth At Risk are funded from a three-year grant from the W.K. Kellogg Foundation. Do you expect funding for these centers to continue beyond fiscal year 1993?

Dr. JOHNSRUD. The six Centers for Action are considered a significant asset to supporting the work of this Extension Initiative. In addition to the first 6 Centers funded with the W.K. Kellogg Foundation, ES–USDA funded an additional Center to provide technical assistance in assessing needs of communities. And, through the cooperative relationship with the Department of Justice and Transportation and the National 4–H Council, a new Center for Action was initiated in 1992. This new Center provides technical assistance to develop community and statewide collaborations. This model of collaboration utilizes the judicial system and other key community leaders in a process to assess needs and establish priority projects for implementation.

The Kellogg funding concludes in the coming year. We plan to have a shared funding model including the Cooperative Extension Services, ES–USDA, other government agencies and private sector funds.

FOOD SAFETY

Mr. DURBIN. The total amount appropriated for food safety in both fiscal year 1992 and fiscal year 1993 was $1,500,000. These funds are used to target participants in the food chain from producers to retailers to consumers and address issues of food safety. During last year's hearing, you said in fiscal year 1992, $1,200,000 had been made available to states on a project proposal basis. States had to submit applications for model food safety educational programs. Would you provide the Committee with a list, by state, and a brief description of those programs funded in fiscal year 1992?

Dr. JOHNSRUD. I will be happy to.

[The information follows:]

EXTENSION FOOD SAFETY & QUALITY INITIATIVE
FY 1992 SPECIAL PROJECTS

CATEGORY 1

Model programs to educate food handlers on ways to reduce the risk of foodborne illness. (Further explanations are given if the title does not sufficiently describe the target audience.)

STATE	TITLE
CO*	Training and Delivery of the Safety & Food Excellence (SAFE) program in the West. (This program is training volunteers and extension agents in 8 states in the western region to deliver a safe food handling curriculum to groups or agencies that serve foods to elderly persons and others with weakened immune systems and to targeted audience members in self care.)
CT	Safe Food Handling in Elderly Feeding Programs.
FL	The Effect of Food Safety Education Programs on Modifying Food-Handling Behavior Among High-Risk Populations. (This program is testing an observational method of evaluation of food handling behavior as well as delivering education. Target audiences for education are persons with AIDS and cancer patients in chemotherapy, and parents of infants, and food workers in nursing and convalescent centers.)
KS	Model Foodservice Sanitation Certification and Training Program. (This program is a train-the-trainer approach for preparing Extension agents to deliver the foodservice sanitation training program, SERVSAFE of the National Restaurant Association.)
KS*	Safe Food for Children: Training for Child Care Providers and Others.
KY	Training Foodservice Workers and At-Risk Groups to Reduce Foodborne Illness. (This program is expanding a previously developed satellite-based interactive food handling training program to food handlers in long term care facilities and adult day care centers.)
MI	Implementation of an Educational Program to Reduce Foodborne Illness in Families. (This program is extending a child-tested interactive hypermedia program--developed for 4th-graders to teach safe food handling practices--with satellite instruction for parents, before/after school providers, 4-H leaders, and school foodservice personnel.)
MN	Food Safety Education Youth Outreach Project. (This program is implementing a curriculum on safe food handling practices for youth school, 4-H and community outreach programs.)
MS	Child Caregivers Training Food Safety & Quality.
NC	A Model HACCP Program for the Handling of Extended Shelf Life Refrigerated Foods. (The target audience is retail food handlers in North Carolina.)
NE	Food Safety for Hispanic Populations. (This program teaches safe handling practices based on HACCP principles through worksite education programs for Hispanics in food establishments.)

NM	Expanded FSQ Programs for Navajo Audiences. (This program is creating touch-screen interactive video instruction on safe food handling specifically tailored to a Navajo reservation.)
OH	A Model Program to Train Occasional Quantity Cooks for Safe Food Handling. (The target audience is the non-commercial food handler, such as church or civic groups that prepare community or large group meals.)
TN	A Model Food Safety Program for Low Literacy Food Handlers. (The targeted food handlers are child and adult day care providers, workers in nursing homes, youth camps and restaurants, and students in vocational training centers.)
VT*	Safety Awareness in the Food Environment II. (This is a multi-state program to educate food managers, handlers and occasional cooks.)
WY	Training Program for Commercial Food Handlers in Wyoming.
CM	Foodborne Illness Reduction Program in Chuuk. (This is an educational program for food handlers, food suppliers and food service managers in the Chuuk State of Micronesia.)

CATEGORY 2

Development of curricular guidelines for food safety risk education.

STATE	TITLE
KS*	Taking a Risk on Food: Curricula for Youth and Adults (This project is reviewing food-related risk education curricula for youth, adults and food handlers, creating an electronically-accessible database, and developing curricular guidelines for food safety education in the Cooperative Extension System.)

CATEGORY 3

Model programs that increase knowledge and understanding of the scientific and policy bases for risk management decisions made to protect the safety of the food supply.

STATE	TITLE
CA	Biotechnology and Foods, UC WHIF (What's In Food) Science Education Program. (This is a parent-youth educational program about biotechnology that expands previous efforts in the model on food additives and pesticide residues.)
CO	Creating Informed Citizens for Tomorrow's Food Safety Decisions. (This program will reach grades six through nine with a school enrichment curriculum covering issue topics such as biotechnology, food additives, natural toxins, and fat and sugar substitutes.)
NJ*	Model Education Program in Food Biotechnology Safety. (This is a program to facilitate community dialogues about biotechnology and promote informed involvement in risk management issues. It utilizes graduates of the Family Community Leadership (FCL) Institutes in a train-the-trainer approach to community education.)
NY	Improving Media Coverage of Food Safety and Risk Management.
PA*	A School Enrichment Program for Youth Addressing Food Safety Policy Issues. (This is an enrichment program for 6th and 7th graders that uses scientific experiments and hands-on activities to introduce children to food safety issues connected to food production, processing and marketing.)
PA	Risk Assessment as a Tool to Implement a Total Quality Management Program. (This project is developing a risk assessment tool to evaluate on-farm risk for residue violation, in connection with the Dairy Quality Assurance Program.)
SC	Food Safety Education for Family Physicians and Patients.

CATEGORY 4

Model programs which reduce violative residues in foods through enhanced utilization of the Food Animal Avoidance Residue Databank (FARAD).

STATE	TITLE
IL*	Residue Avoidance: Evaluation of the Diary Quality Assurance Program and the Approach to Total Quality Management. (This is a multi-state, inter-disciplinary national project that includes Illinois and Virginia (co-leaders), Pennsylvania, New York, California, Florida, Kansas, Wisconsin, Michigan, and Nebraska. It is building capacity among the Extension Service veterinary and dairy science specialists, veterinary dairy clinicians from the Food Animal Medicine Production Consortium, the National Milk Producers Federation, Agri-Education and the American Veterinary

	Medical Association. This project will continue the major leadership role the Extension Service has played in the development, promotion and management of the national dairy quality assurance program.)
FL	Food Safety and Quality Assurance Program in Aquaculture Utilizing the Food Animal Residue Avoidance Databank. (Information specific to therapeutic agents used in aquaculture will be collected. New databases will be developed in conjunction with the existing FARAD. Recommendations based on the information collected will be disseminated to state and local aquaculture specialists and producers in order that a national quality assurance program be developed to prevent drug residues.)

CATEGORY 5

Model TQM and HACCP programs to minimize hazards in foods.

STATE	TITLE
CO	National Sheep Quality Assurance and Food Safety Program. (The four-year efforts of the Colorado State University Sheep Integrated Resource Management Team (SIRM) will provide the leadership to develop a National Sheep QAP and Food Safety Program with major support and financial contributions from the American Sheep Industry, National Lamb Feeders Association, packers, wool purveyors, brokers, distributors, retailers and producers. After a national audit of the sheep industry, a model quality assurance program will be developed and distributed to producers, 4-H, and FFA groups, and will be implemented through the American Sheep Industry Association Producer Services Health Committee.)
MD*	HACCP Principles in Reducing Salmonella Hazards on Broiler Grow-Out Farms. (The purpose of this program is to demonstrate the value of applying Hazard Analysis Critical Control Points (HACCP) and quality assurance methods at the farm level to reduce the risks of Salmonella contamination in chicken products available to the consumer.)
IA*	A Model TQM Program for Youth Producers. (This multi-state project will extend TQM systems to 4-H and FFA youth who are involved in pork, beef, lamb, milk, poultry and fish production by producing and delivering a one hour satellite program to emphasize the obligations of youth involved in food production and to introduce the concepts of quality assurance and TQM.)

* Multistate projects

Mr. DURBIN. How many reducing the risk of foodborne illnesses from improper food handling models have been developed and where are they in use?

Dr. JOHNSRUD. With special funding from FY 1991 and FY 1992, numerous approaches to food handling education have been developed and are undergoing demonstration. Train-the-trainer approaches that are attempting to build community leadership and Extension staff capacity for providing education have been developed for foodservice manager certification programs, occasional quantity cooks, providers of institutional or family home adult and child care, and health professionals. Variations of these programs are in use in Colorado, New York, Washington, Idaho, Montana, Utah, Wyoming, Arizona, New Mexico, and Kentucky. Other states are in the process of adapting this model to state-specific needs.

In other models, Extension staff is the primary deliverer of education, although planning and implementation involve collaborative efforts with other state agencies and organizations. In some of these models, Extension has developed the curriculum and sometimes offers a certification of training (e.g., North Carolina, Mississippi, and Ohio). In other situations, Extension staff are being certified to deliver the National Restaurant Association's SERVSAFE certification program for food service managers (e.g., Kansas, Pennsylvania and Virginia). The models vary in delivery mechanisms among interactive satellite workshops, teaching on-site conferences, and combinations of workshops with follow-up materials such as newsletters.

Another way to look at models is to look at the audiences served. Some programs have been developed in collaboration with large numbers of community groups and agencies and are applicable to various audiences, from elderly care staff to occasional cooks (e.g., in 9 Western region states, Ohio, Vermont, New Hampshire and Connecticut). Other programs have been specifically tailored to meet the needs of high-risk targeted audiences (e.g., AIDS and cancer patients in Florida or Navajos in New Mexico).

The models vary among States and sometimes local jurisdictions, due to different regulatory requirements for training, available facilities and staff, resources, available collaborators and community- or state-based needs determinations. Extension staff are able to work with collaborators and communities to tailor programs to their needs. This is not an exhaustive list of food handler education being conducted in the Cooperative Extension System, but a means to look at the various models supported with special funding and now available for transfer to other states.

Mr. DURBIN. Are there educational training materials available on this subject that could be distributed nationwide?

Dr. JOHNSRUD. There are numerous materials available and already being distributed across State lines. As a part of the capacity-building goal of the Food Safety & Quality Initiative, the final report of all the funded projects in distributed to Extension Initiative contacts in every State and Territory. Therefore, the availability of educational materials on safe food handling is made known to all partners in the Cooperative Extension System. There has been heavy interest in transferring materials nationwide. In addition, some States that developed model programs have provided

leadership to multi-State efforts for dissemination and duplicating programs that have been very successful.

Many partners of the Cooperative Extension System are also routinely sharing food safety educational materials with others, both within and external to the CES. Some small adaptations are often needed in materials for food handlers, as regulations currently vary among States (e.g., specific recommended cook or hold temperatures may need to be made State-specific). An electronically-accessible database that will provide program descriptions and contacts for curricula on food handing and adult and youth food safety risk education is in development.

FARAD

Mr. DURBIN. You also stated last year that $200,000 to $300,000 would support expansion of the Food Animal Residue Avoidance Databank. Please describe this in further detail.

Dr. JOHNSRUD. The Food Animal Residue Avoidance Databank—FARAD—is a national Extension Service Program designed to ensure the safety of the food supply by minimizing the incidence of harmful drugs and chemicals in foods of animal origin. Through FARAD, livestock producers, veterinarians, extension specialists and agents, and state and federal food safety officials can access critical information needed to prevent adulterated products from entering the food supply. FARAD's focus is food safety through prevention and mitigation of residues.

FARAD produces several compendia of approved animal drugs and sells several thousand of these at cost every year. Assistance is also available by telephone at three regional access centers at the University of Florida, University of Illinois and University of California, Davis. Most callers want to know how long they must withhold animals or animal products from market channels until they are considered safe for human consumption. In addition, FARAD has provided critical information during episodes of widespread contamination such as heptachlor incidents in Hawaii and Missouri.

To help callers establish appropriate withholding times it is necessary to review all available sources of information. These data are constantly being gleaned from the Federal Register, published books, and scientific literature. The data are reanalyzed and entered into FARAD for immediate access.

To prosper, animal producers and veterinarians must be able to treat sick animals. Food safety is a primary concern of consumers. FARAD is one of the best resources to help veterinarians establish reasonable times for marketing animals after drug use and this is done by providing comprehensive, current scientific information.

Mr. DURBIN. How is the $1,500,000 being used in fiscal year 1993?

Dr. JOHNSRUD. $1,170,000 has been made available to the State and Territories on a competitive basis through a Request for Applications. In the selection process for projects to be funded, priority will be given to educational programs that build on, utilize, integrate and/or promote cooperation among existing programs, that develop appropriate collaborative efforts to address issues between disciplines and among the private and public sectors, and that im-

plement, test, and evaluate programs and materials. New educational materials will be supported if they address a clearly defined gap in current programs.

Funding categories for educational programs consist of: Programs to educate food handlers (adult and youth) on ways to reduce the risk of foodborne illness; programs that increase understanding of risks and responsible practices of all members of the food chain relative to food production and processing decisions; programs which reduce chemical residues by enhanced implementation and producer adoption of food animal or aquatic quality assurance and total quality management programs and which utilize and evaluate the Food Animal Residue Avoidance Databank—FARAD—programs which enhance the implementation and adoption of TQM and HACCP principles to control microbial hazards in food animal or aquatic production; and youth food safety animal or aquatic production programs that integrate the concepts of quality assurance, HACCP, TQM and/or Best Management Practices.

Another $210,000 from the $1,500,000 is supporting expansion and operation of the Food Animal Residue Avoidance Databank (FARAD) at the Universities of Florida, Illinois and California-Davis.

Mr. DURBIN. Are the five Hazard Analysis and Critical Control Point model educational programs that were near completion last year operating?

Dr. JOHNSRUD. A model for development of HACCP systems in retail food operations being developed at the University of Californa-Davis, in cooperation with 13 retail food operations in California. The manual for development of HACCP systems for food retailers and delicatessens in scheduled to be printed March 23, 1993. The manual orients users to HACCP principles and suggested systems and provides guidance on putting a plan in place. It has already been written about and/or advertised in a publication which services food retailers and delicatessens nationwide. A dozen requests from supermarket managers nationwide have been received even prior to availability. After printing, it will be marketed and made available to numerous interested industry members and their associations, such as the No. and So. California Delicatessen Councils, the No. and So. California Grocers Assns., the Food Marketing Institute, the U.S. Food and Drug Administration, and the University of California's Sea Grant and Seafood Technology mailing lists, in excess of 5,000.

A model for small locker and meat processing plants for raw beef products being developed at Kansas State University. The program is operating with the only facility that was chosen as a test facility for development of the model, the Kansas Correctional Facility Meat Plant in Oscaloosa, KS. Employees have been trained and environmental and meat samples are being collected to assess the effect of the HACCP implementation. As the meat industry in Kansas has become aware of the program, many requests have been received for assistance in implementing HACCP in various plants. Two plants have been supported at this time, chosen for the large quantity of production going to national foodservice chains like Kentucky Fried Chicken or Sonic. Once the final report is

issued around June 30, 1993, other states will be informed of the model.

A model for small and medium-sized red meat processing plants developed at Colorado State University. Training sessions were held in 1991 and 1992 for extension agents and cooperating meat processing plants. HACCP models were developed for cooperating plants and should continue to be a part of their continuing quality and safety assurance efforts. The program can be adopted for other interested small- and medium-sized meat processors. A model for small scale entrepreneurs and other nontraditional food processors developed at the University of Nebraska.

This model program was an introductory workshop on critical controls in food processing and HACCP principles. The target is small- to medium-sized companies and nontraditional food processors. After the initial workshops during the FY 1991 project year, the program continues in many ways. On-site visits are made to companies in Nebraska who need HACCP assistance. The program is being modified to develop training for NE Department of Agriculture inspectors being prepared for a HACCP-based inspection system. Through the Nebraska Food Processing Center in Lincoln, NE, entrepreneurs are taught the basics of food safety and HACCP. Other related Extension materials on food microbiology and sanitation have been developed in Nebraska to complement the program. Additional workshops, sometimes multistate, have been held in 1992 and 1993 for small meat processors, foodservice workers, dietary managers from nursing homes and hospitals, and caterers across Nebraska. County health departments in 11 other states have requested materials.

A model program to train catfish producers and processors in Mississippi about HACCP. Materials for this project are in final editing; it has been important to obtain input from multiple state and federal agencies and the industry. These materials, predominantly videotape instruction, will be distributed to processors and producers immediately after that. An extensive use in states producing catfish is anticipated. In addition, the Veterinary Health Council of the Pan American Health Organization has requested permission to translate the videos into Spanish.

INDIAN RESERVATION EXTENSION PROGRAMS

Mr. DURBIN. Please provide the Committee with some specific examples of how the funds appropriated for Extension agents on Indian reservations are used.

Dr. JOHNSRUD. I will provide the information for the record.

[The information follows:]

SOME SPECIFIC EXAMPLES OF HOW FUNDS APPROPRIATED FOR EXTENSION AGENTS ON INDIAN RESERVATIONS ARE USED

ALASKA

One Extension agent providing subsistence agriculture self-sufficiency programs in rural interior Alaska ($79,500).

ARIZONA

Five Extension agent positions in the San Carlos Apache, Hopi, Colorado River and tri-state (AZ, NM, and UT) Navajo reservations providing agriculture enterprise development and youth programs (combined funding of $289,000).

CALIFORNIA

Extension agent in Hoopa Reservation providing educational programs for adults and youth in fisheries, forestry and agriculture development ($77,560).

IDAHO

Ft. Hall Reservation has an Extension agent providing leadership in after school training and mentoring programs in agriculture, horticulture, 4–H youth leadership, nutrition and health for K–5 youngsters ($67.475).

MINNESOTA

Red Lake Reservation Extension staff train volunteers and assists 200 students in high school to overcome problems with drugs, alcoholism and other issues facing Native American youths.

MONTANA

Five Extension agents serve the Blackfeet, Salish and Kootenai, Fort Belknap and Northern Cheyenne Reservations to help adult and young farmers and ranchers develop management and capital acquisition skills, crop and livestock production knowledge, networking with federal, state and other agencies and organizations to more effectively meet the needs of the people and expand services with limited resources, and work to protect the natural resources (combined total $254,000).

NEW MEXICO

Two states are served by an Extension agent on the Jicarilla Apache and Colorado Ute Reservations who provides programs in sheep, cattle and farming/agronomy ($67,000).

NEVADA

Three reservations, the Paiute, Shoshone and Washoe, are served by an Extension livestock and youth specialist who is helping ranchers manage range and cattle operations ($72,000).

NORTH DAKOTA

Extension agent is developing unique traditional agriculture enterprises emphasizing long-range financial planning, Integrated Resource Management (IRM) livestock performance testing, and forage production on the Ft. Berthold Reservation. Youth programs include summer programs to develop leadership and job skills, entrepreneurship and learn more about Native American culture ($72,000)

OKLAHOMA

Extension agent organizes science-based 4-H youth programs for the Muskogee-Creek and Choctaw Nations ($50,000).

SOUTH DAKOTA

Two agents serve the Pine Ridge and Rosebud Reservations adults and youth with beef production, range and ranch management, pesticide applicator training, horticulture, 4-H youth and school enrichment programs ($75,000).

WASHINGTON

Extension agent helps develop aquaculture enterprise and youth programs in the Chehalis Reservation ($85,000).

WYOMING

Wind River Extension agent facilities multiagent extension expert teams to provide ranching and range management and human and natural resources programs ($84,000).

Mr. DURBIN. How many projects were funded in fiscal year 1992 and how many are planned for fiscal year 1993?

Dr. JOHNSRUD. For FY 1992, 29 programs totaling $1,380,000 were funded. In FY 1993, 34 programs at $1,610,000 are being funded.

Mr. DURBIN. Were any requests for assistance turned down due to lack of funding?

Dr. JOHNSRUD. Yes. Total of requests denied funding were 39 in 1991, 17 in 1992 and 14 requested in 1993.

Mr. DURBIN. Do the reservations provide any matching funds to this program?

Dr. JOHNSRUD. Yes. 1993 matching tribal funds total approximately $400,000 ranging from $1,000 for short-term special projects to $40,000 for agent programs.

EDUCATIONAL BASE PROGRAMS

Mr. DURBIN. The Extension Service operates seven base programs which are educational programs central to your mission and common among Extension units. We have five new Members on this Committee this year who may or may not know what these base programs are. Would you list them and briefly describe each?

Dr. JOHNSRUD. Base Programs are the major educational efforts central to the mission of the System and common to most Extension units. The base programs are the ongoing priority programs efforts of the System, involving many discipline-based and multidisciplinary programs. They can be thought of as the foundation of a building, while the National Initiatives rise from the base to receive special emphasis for a period of time. I will provide a description of the educational base programs as approved by the Extension Committee on Organization and Policy—ECOP—and ES–USDA for the record.

[The information follows:]

AGRICULTURAL COMPETITIVENESS AND PROFITABILITY

Educational programs emphasize systems approaches that maintain and enhance profitability through the application of sound crop and animal production practices. Farm business management, marketing, decisionmaking skills, and environmental considerations are the focus. These problem-oriented programs transfer latest proven technologies to clientele and promote optimum use of resources consistent with environmental and family goals.

COMMUNITY RESOURCE AND ECONOMIC DEVELOPMENT

Educational programs target development of all community resources, emphasizing economic viability. The focus is to teach comprehensive community analysis to help communities create strategies to strengthen existing employers, attract new enterprises, and encourage local entrepreneurship. To increase community viability and aid socioeconomic transitions, programs include community services and facilities, housing, and human development through leadership and public policy awareness.

FAMILY DEVELOPMENT AND RESOURCE MANAGEMENT

Educational programs help individuals and families develop the competencies to become healthy, productive, financially secure, environmentally, responsible members of society. Education is targeted to management of resources—including money, time, apparel, and energy; strengthening individual and family relationship; providing quality care for children; and maximizing independence of the elderly.

4-H AND YOUTH DEVELOPMENT

Educational programs focus on building lifelong learning skills that develop youth potential. This extensive set of programs is designed to engage youth in healthy learning experiences, increasing self-esteem and problem-solving skills. Programs address stress management, self-protection, parent-teen communication, personal development, careers, outreach and interchange, and global understanding. A wide range of content offerings encourage youth to explore science, technology, and citizenship.

LEADERSHIP AND VOLUNTEER DEVELOPMENT

Educational programs emphasize developing life skills, especially leadership. Leadership and volunteer programs empower participants to improve their self-esteem and life skills and strengthen the communicates in which they work and live. Volunteers multiply program impacts, expand public policy education, and improve community organization and leadership.

NATURAL RESOURCES AND ENVIRONMENTAL MANAGEMENT

Educational programs focus on management, use and sustainability of natural resources with special attention to environmental stewardship and biodiversity. Programs encompass soil, water, air, and plant management; fish and wildlife management, aquaculture, conservation, and forestry; sustainable use and management of rangelands, wetlands; and wildlands; land use planning; and use of information systems.

NUTRITION, DIET AND HEALTH

Educational programs provide individuals and families with a knowledge base to make informed decisions about food, nutrition and health. Objectives include helping people achieve and maintain optimum weight and reduce the risk of chronic disease; give birth to healthy babies; practice responsible and healthy self-care; help children attain optimum long-term health; minimize nutritional inadequacies and abuses in foods; and improve consumers' ability to make informed choices related to food safety, quality, and composition. Programs are shaped by the Nation's dramatic changes in family structure and lifestyle and are targeted for the nutritionally vulnerable.The Expanded Food and Nutrition Education Program (EFNEP) is an example of a program that reaches out to achieve these objectives with low-income families with young children.

RREA

Mr. DURBIN. Please update the table that appears on page 583 of last year's hearing record showing the budget request and amount appropriated for the renewable resources extension program to include fiscal year 1993.

Dr. JOHNSRUD. I will provide that for the record.

[The information follows:]

RREA

Fiscal year	President's budget	Amount
1983	0	$2,000
1984	0	2,000
1985	0	2,500
1986	0	2,378

RREA—Continued

Fiscal year	President's budget	Amount
1987	0	2,378
1988	0	2,765
1989	0	2,765
1990	0	2,744
1991	0	2,765
1992	0	2,765
1993	0	2,765

D.C. EXTENSION

Mr. DURBIN. Please provide for the record a ten-year table showing the Federal and non-Federal funding level of the D.C. Extension Service, as well as staff levels.

Dr. JOHNSRUD. I will be happy to.

[The information follows:]

	Staff years	Federal funding	Non-Federal funding
1982	35	$983,000	$863,500
1983	32	983,000	1,235,489
1984	29	983,000	983,000
1985	28	983,000	1,226,000
1986	30	935,000	983,000
1987	30	935,000	1,083,000
1988	30	935,000	1,083,000
1989	26	953,000	1,083,000
1990	25	946,000	1,296,917
1991	24	991,000	1,296,917
1992	28	1,010,000	983,000

DISADVANTAGED FARMER ASSISTANCE GRANTS

Mr. DURBIN. Provide the Committee with some specific examples of how the funds appropriated for the disadvantaged farmer assistance program are used.

Dr. JOHNSRUD. I will provide the information for the record.

[The information follows:]

IOWA: One-on-one support for farmers and families on stress management with professional referrals for mental and physical health care, legal, food, housing and fuel aid. Planning assistance provided, such as farm financial analysis and basic job search skills. Community assistance included needs assessment and specific activities, such as a Gulf War support group, county child abuse prevention council, domestic violence shelter educational activities, and participation on Governor's Homeless task force.

KANSAS: Supported annual Working with Families conference and continued partnership with Farmers Assistance, Counseling and Training Service (FACTS). Workshops held for county agents, rural support groups and mental health care providers focusing on resources, stress management, family communications and helping skills. An estimated 160 positive farm and rural family crisis interventions resulted. Expanded alternative employment and alternative farm income generating activities. The Kansas DIRECT information and referral service assisted 70 clients with alternative employment or income-generating activities, seven enterprises were expanded or retained and 34 jobs created.

MISSISSIPPI: Increased farmer knowledge and understanding of marketing, financial management and farm financial stress, risk management and business management. Horticultural crop projects helped over 100 limited income/minority farm families who sold nearly $200,000 worth of crops. Farm and family financial management center provided one-on-one assistance to approximately 50 families, helping to restructure debts, develop farm plans and liquidate farms in an orderly fashion. Youth career and life planning program conducted in four schools covering occupational areas: personal skills including communications; conflict management and resolution; interviewing and job application forms; work habits and attitudes; self-esteem and personal responsibility. Farm business management clubs have assisted clients beginning operation, created 40 new jobs, and kept businesses experiencing financial difficulty operating.

MISSOURI: Over 900 rural, farm, laid-off or dislocated workers throughout the state have attended intensive Career Options Workshops on resume writing, cover letters, job applications, networking, job hunting strategies, and practice job interviews with individual career counseling sessions. Each participant received a letter-quality resume and monthly newsletter with career/employment information.

Through a toll-free career information/working reentry Hotline, information provided about occupations, education, job hunting skills, and a referral system helps distressed individuals obtain additional help. Other activities included mental health outreach consultation and referral services, informal mediation among clients and agencies, collaborative casework with community institutions, such as schools and human service councils working on community change projects. Expanded alternative employment or alternative farm income-generating activities.

NEBRASKA: The University of Nebraska Cooperative Extension, in partnership with Job Training of Greater Nebraska, the Department of Public Institutions, the State Department of Health and the Interchurch Ministries of Nebraska, local governments and health care providers, is responding to needs of distressed farmers and rural families through a Rural Response Partnership. Outreach services are provided to financially distressed farmers and ranchers to allow those wanting to remain in production agriculture to do so and to allow others to develop employment alternatives. Through Extension's Center for Rural Community Revitalization and Development, program support is provided for educational activities that stimulate local community and economic development planning; leadership development is provided for existing and emerging local leaders concerned with the social and economic viability of their rural communities. Counseling outreach and mental health services are also provided.

NORTH DAKOTA: Support is provided for HELP-LINE, a state-wide, toll-free 24-hour telephone crisis referral service. During 1991, there were nearly 6500 crisis calls and over 8500 information and referral calls. Rural Community Survival Task Force helped promote development of training opportunities for professionals and volunteers involved in crisis counseling and referral. Extension Center for Rural Revitalization set up a data base computer program with sources of assistance for the entire state for personal and family crisis situations. Prepared agricultural economics reports on the tax implications of liquidating a farm operation, legal rights of debtors and creditors-bankruptcy for financially distressed farmers. Subcontracted with the Greater North Dakota Association to plan formation of a rural development council in North Dakota. Established a pilot youth self-esteem summer education program at the Ft. Berthold Indian Reservation. Participated in "Marketplace '92," which drew over 3,000 participants to a one-day event featuring over 100 Idea Booths and over 70 Learn-About sessions helping farm families discover new economic development and alternative income ideas that work in North Dakota.

OKLAHOMA: Extension continues to work with Oklahoma Helping Hand, a program to assist financially stressed and dislocated farmers, in partnership with the Oklahoma Area Health Education Center at the College of Osteopathic Hospital at Oklahoma State University, the Northwest Area Health Education Center, and designated liaisons from the state Department of Mental Health and Substance Abuse Services, and regional mental health clinics. The primary intent is to improve access to, understanding of, and use of mental health care.

Pilot efforts are proceeding to develop a Rural Mental Health Task Force. Extension is continuing to develop a network of "first responders" and counselors. Efforts are continuing to orient Eastern Oklahoma Area Health Education Center personnel to train them to conduct focus groups, provide ongoing consultation and support and they extend mental health services. Counseling is continuing in crisis management, farm and family financial planning, alternative income opportunities training and job search and business skill development. Educational programs for home-based and micro business owners will be expanded with updated program materials relating to business management and expansion and conferences and workshops conducted on how to get started in a variety of businesses. These efforts will continue in partnership with the Small Business Development Center, the Service Corps of Retired Executives, Oklahoma Departments of Commerce and Agriculture, and the Oklahoma Association of Electric Cooperatives.

VERMONT: Provided individual help to financially and emotionally stressed farm and rural families including alternative income opportunities from financial credit options, supplemental income, off-farm employment and living on reduced income. The Family and Agricultural Resource Management (FARM) program continues a three-tier approach to client service: outreach with one-to-one consultation; programming with workshops (sheep and fallow deer), seminars, and conferences; and publications and other resource materials. Scholarships were provided clients to attend pro-dairy courses on crop and feeding management. Worked with approximately 1000 families to combat factors of isolation, financial stress, emotional stress, inadequate knowledge of available services, poor communications skills, and lack of attention to matters of personal health and safety.

Mr. DURBIN. How were these funds allocated to the States covered by this program? Provide a breakout.

Dr. JOHNSRUD. I will provide that information for the record.

[The information follows:]

State:	Allocation
Iowa	$365,415
Kansas	379,185
Mississippi	244,035
Missouri	365,415
Nebraska	365,415
North Dakota	273,360
Oklahoma	313,140
Vermont	142,035

CHINCH BUG/RUSSIAN WHEAT APHID (NE)

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. This is a new program; received first funds October 1, 1992. For the chinch bug, the project objectives are to: demonstrate to growers and their advisors the effectiveness and optimal conditions for deployment of sustainable cultural management strategies for the chinch bug, including trap crops, barrier strips, separation of susceptible crops, and elimination of poor stands; and educate growers and their advisors about the relative success of growing sorghum versus corn in southeastern Nebraska and adjacent states during chinch bug epidemics.

For the Russian Wheat Aphid, the project objectives are to: demonstrate to wheat growers the economic value of sampling and using economic thresholds in the management of the Russian Wheat Aphid; demonstrate to growers the importance of sustainable cultural practices on management of the Russian Wheat Aphid; demonstrate to wheat growers the characteristics that Russian Wheat Aphid populations will have when resistant varieties are introduced; and develop educational materials for use in training wheat growers to recognize Russian Wheat Aphid and its damage.

Growers in southeast Nebraska have suffered $11.3 million in sorghum losses in 1989 and 1990 because of the chinch bug. It is estimated that it has cost growers in Nebraska over $7.5 million in control costs for Russian Wheat Aphid as well as losses of yields in an area of narrow profit margins in the panhandle area.

Mr. DURBIN. Where is this work being carried out?

Dr. JOHNSRUD. The work is being carried out at the University of Nebraska, Lincoln, Nebraska. The Chinch Bug work is primarily in Southeastern Nebraska, while the Russian Wheat Aphid work is in the Panhandle of Nebraska.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. Implementation is just beginning, as this is a new project.

Mr. DURBIN. What is the estimated completion date of this program?

Dr. JOHNSRUD. The estimated completion date of this program is September of 1996.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr. JOHNSRUD. Yes. However, keeping with the Administration's policy of awarding grants competitively, no further Federal funding is requested. If these programs are high priorities for the State, the State extension service could redirect existing funding to support the program.

PRESQUE ISLAND, ME

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. A major educational aspect of the Cooperative Extension System's Integrated Pest Management Program is the use of paraprofessional scouts to survey fields for agricultural pests and to assist in teaching IPM concepts to participants. In order to do this, some funding has been used for new vehicles so as to insure increased productivity through increased client contact and client participation. Other funds have been used to develop videotape production capabilities that have greatly enhance the educational outreach of UMCE. For example, this equipment is being used by UMCE faculty to produce Farm Notes, a televised series of educational sports for Maine farmers, and another video concerning Potato Storage Construction and Improving Potato Strains. Other videos are nearly complete; one on soil testing and fertilizer management; another on potato ecosystem research, and another on potato integrated pest management. Other Federal funds have allowed UMCE to develop a state-of-the-art plant disease diagnostic laboratory and a greenhouse.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JOHNSRUD. The project has been underway since fiscal year 1990. Total funding appropriated through fiscal year 1993 is $652,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JOHNSRUD. The work is being carried out at the IPM office in Orono; Presque Isle Extension Office; and Monmouth, Maine-Highmoor Farm Extension Office.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. The accomplishments to date are:

Increased testing and release of new low input potato varieties, such as Maine Chip for chip potato production; Prestile for round-white table stock production—requires less nitrogen for profitable yields and virus resistance reduces the need to apply systemic insecticides and aphicides; and Allegany for round-white chip and table use—late maturing, requires less nitrogen, blight-tolerance reduces the need for fungicide applications, and nematode-resistance reduces the need for systemic insecticides and nematicides.

These three varieties were not planted on 3.5 percent of Maine potato acreage in 1992 and are expected to be planted on 10 percent of acreage in 1992. Over 300 growers make regular use of UMCE interactive television, satellite television and video teaching capabilities made possible with equipment purchased with funds

provided by the first grant. One hundred percent increase in the number of applied research and demonstration trials of integrated pest management and low input sustainable agriculture strategies made possible with new equipment purchased with Federal funds.

Mr. DURBIN. What is the estimated completion date of this project?

Dr. JOHNSRUD. The Integrated Pest Management and Sustainable Agriculture programs are ongoing educational efforts in the state of Maine and will continue as long as funding is available.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr. JOHNSRUD. Although there certainly have been benefits from this program, we continue to believe that additional Federal IPM resources should be distributed on a merit basis. Maine could devote Smith-Lever 3b&c Formula Funds to this project, or its allocation of IPM funds.

Keeping with the Administration's policy of awarding grants competitively, no further Federal funding is requested. If these programs are high priorities for the State, the State Extension Service could redirect existing funding to support the program.

CROP SIMULATION, MS

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. The crop simulation project involves GOSSYM-COMAX which is the result of over 15 years of collaboration among many organizations. The joint venture has been led by USDA-Agricultural Research Service (ARS), Clemson University (SCAES), and Mississippi State University (MAFES). Extension Service-USDA (ES), ARS, SCAES, and MAFES have agreed to work together to continue the beltwide implementation of GOSSYM-COMAX based upon positive responses received from a 1986–1988 pilot effort. This 3-year pilot was jointly funded by ARS, ES, 13 cotton-producing States, and the National Cotton Council. The purpose of the project was to extend GOSSYM-COMAX to a broader base of growers.

For the 1989 growing season, the GOSSYM-COMAX Information Unit (GCIU) was established. Expenses were shared by ARS and ES to employ two full-time people to function in the GCIU for the 1989 growing season.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JOHNSRUD. This project was first funded in 1990. With 1993 funding, the total amount is $1,990,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JOHNSRUD. The GOSSYM-COMAX decision support system is being offered to all cotton producing States. The following States are currently active participants: Alabama, Arizona, Arkansas, California, Florida, Louisiana, Mississippi, Missouri, New Mexico, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. The GOSSYM-COMAX Information Unit (GCIU) has functioned to enhance, extend, and support the GOSSYM-

COMAX software to cotton producers, researchers, and extension staff. The number of GOSSYM-COMAX users who have been trained and supported has grown from approximately 150 in 1989 to over 300–400 users in 1993. The number of acres under GOSSYM-COMAX management is estimated at approximately 500,000. The software has been enhanced greatly during this time. A graphical user interface—GUI—was implemented beginning with the 1990 release. The training and understanding of the software has been greatly simplified with the GUI. The software has been moved into a state-of-the-art status and been of much greater value to the user by the enhancement of the GUI.

Mr. DURBIN. What is the estimated completion date of this program?

Dr. JOHNSRUD. We are striving to turn this program over to the private sector, particularly the software package which the private sector can then enhance and sell for profit. Crop simulation is a dynamic area which needs research-based results for improvement. As those results become available, ES will use that information to enhance decisionmaking of its clientele. The intent was to support GCIU for 5 years, and fiscal year 1993 represents the 4th year of support.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr. JOHNSRUD. Because of the research and extension support of crop simulation and expert systems, cotton farmers are making decisions regarding chemical fertilizers, water, and pesticides that are increasing their net profit (near $40 per acre) and that are more environmentally sound.

Keeping with the Administration's policy of awarding grants competitively, no further Federal funding is requested. If these programs are high priorities for the State, the State extension service could redirect existing funding to support the program.

HOME SEWING—MS, SC, AL

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. Three models have been developed in Mississippi, Alabama, and South Carolina for teaching entrepreneurs how to apply business management skills, marketing skills and competitive skills essential for establishing and maintaining a profitable home based business. A fourth State, Oregon has been added this year. Target audiences included financially stressed families, low income families and families who lacked capital to start a business. Existing contract dates are: MS 04/01/93 to 03/31/94; SC 04/01/93 to 03/31/94, AL 05/01/93 to 04/30/94, and Oregon 04/01/93 to 04/31/93.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1992?

Dr. JOHNSRUD. Mississippi has been in the program for four years and has received $182,200. South Carolina has participated for three years and has received $141,390 and Alabama has been in the program from three years and received $71,000. This is the first

year for Oregon to participate in the programs. They received $36,040.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. Thirteen "Sewing As A Business Workshops have been conducted at six locations in Mississippi since 1989 with 277 men and women graduating from the program. Over seventy-five percent of the participants are currently in home-based sewing business. In the last six years, the program has saved the entrepreneurs over $155,000 in workshop fees and generated over $5,000,000 of supplemental income for their families. The Mississippi program, now a collaborative effort between the 1862 and 1890 institutions, targets low income participants.

In 1991, the Alabama Extension Service in conjunction with the School of Human Sciences developed a Satellite Conference entitled, "Sewing Update for Entrepreneurs" that featured successful entrepreneurs, retail resources, trends and technical materials. The program was uplinked to 67 counter in Alabama and sent to nationwide. This emphasis is being continued in 1993.

South Carolina, where the apparel industry alone lost over 5,000 jobs in 1990, CES targets displaced textile workers at its workshops. In the past 2 years, seven workshops have been held with a total participation of 138. The estimated value of industry donations to this program is $77,600. In addition, other Extension programs in South Carolina have benefitted from The Sewing As a Business Project. A total of 235 South Carolina agents, volunteers, and youth participated in five 1-day workshops.

Sewing As A Business Workshops will be developed, delivered, and evaluated in four locations in Oregon. The content of the workshops will be adapted from the Mississippi Cooperative Extension Service model of five-day workshops. The Workshops program will recognize current fashion, local interests and needs, and availability of local resources. Workshops will be held in counties or cities on the "severely affected communities" list of the Oregon Economic Development Department list.

Mr. DURBIN. What is the estimated completion date for this program?

Dr. JOHNSRUD. The current projects are funded for fiscal year 93. The successful models developed in these states are being modified and implemented in other states.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr. JOHNSRUD. These projects have provided three successful models for teaching knowledge and skills for establishing and maintaining profitable home-based skills resulting in new business practices. Other states can be expected to adapt the models and expand the focus to additional business opportunities and audiences.

Keeping with the Administration's policy of awarding grants competitively, no further Federal funding is requested. If these programs are high priorities for the State, the State extension service could redirect existing funding to support the program.

INCOME ENHANCEMENT DEMONSTRATION (OH)

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. The future profitability in American agriculture depends on the ability of producers to maintain competitiveness in global economy. An important factor in Ohio is the potential for farmers to diversify into profitable agricultural enterprises which would improve their ability to better use their existing resources for enhancing income. Gain in profitability can be achieved in a variety of ways including improving business practices, identifying new markets, cooperative efforts, value-added food processing, and alternative enterprises. The project was formed to provide economic and technical analysis on items such as alternative farm enterprises, improving business practices, new uses for current farm output, new markets for farm output, direct markets for farm output, and analysis of value-added food sectors within the relevant Northwest Ohio region. This project has addressed these issues in 8 Northwest Ohio counties, comprising a large and diverse base of nearly 8,000 farms and over 1.6 million acres of farmland.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JOHNSRUD. This project began March 1, 1991. A total of $395,000 has been appropriated for this project since its inception.

Mr. DURBIN. Where is this work being carried out?

Dr. JOHNSRUD. The work is being carried out in an 8-county area in Northwest Ohio. The counties include: Williams, Fulton, Lucas, Defiance, Henry, Wood, Ottawa, and Sandusky.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. The accomplishments under this project to date include:

The economic development potential of agriculture and value-added food sectors was assessed within the Toledo Metropolitan Statistical Area. This assessment indicated that economic development efforts in the area should focus on meat and egg processing and beverage processing. Each dollar expansion of these sectors of the local economy would generate $1.39 in expansion in the total economy of Toledo, a leverage factor of 39 percent. As a result of the assessment, a Fayette Packing Plant Task Force was formed to attract a major new hog packing plant to the Toledo area.

The ABE Center and the Farm Income Enhancement Program has been working with this group in developing business plans and analyzing other factors necessary to attract a new plant. A major new plant in the area would add 20,500 new jobs to the Ohio economy and add nearly $2.5 billion annually to economic output. Income would be enhanced annually in the entire economy by over $430 million.

The role of food and agriculture was assessed within the 8-county area of Northwest Ohio. This assessment indicated that the food and agriculture output in this area exceeds $29 billion annually, or about $1 out of every $8 for the entire economy of the area. The food and agriculture sector also accounts for 1 of every 6 jobs in the area.

The downtown Toledo Farmers' Market was revitalized. The governance structure for this market was changed, as a direct result of this project, from the city of Toledo to farmers and vendors that use the market. This change also will allow the market to expand and prosper in the downtown area, enhancing economic activity of the urban area, benefitting both farmers and consumers.

An Agricultural Business Enhancement (ABE) Center, operating out of the Lucas County/Ohio State University Extension Office was established. The Center is specifically designed to assist commercial agricultural producers with enhancing their farm income. There is an Advisory Committee for the Center, consisting of 23 persons. The Center has helped producers in the 8-county area by assessing new and alternative crops appropriate to this region.

Mr. DURBIN. What is the estimated completion date of this program?

Dr. JOHNSRUD. The Ohio State University Extension Service estimates that completion of project objectives will take another 3 years.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr. JOHNSRUD. Yes. However, keeping with the Administration's policy of awarding grants competitively, no further Federal funding is requested. If these programs are high priorities for the State, the State extension service could redirect existing funding to support the program.

BEEF PRODUCTION IMPROVEMENT (AR)

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. The time period for this project is March 1, 1992 through February 28, 1993. Since this is the first full year of the effort much of the work that has been done has related to building the foundation for the program. The first phase of the effort has been to identify 10 demonstration farms where producers are willing to volunteer their time and facilities to demonstrate improved beef management systems. On each of the 10 farms a complete set of baseline data is being collected. The base line data includes financial and economic position, natural resource situations, beef cattle and genetic status.

Mr. DURBIN. How much has been appropriated through fiscal year 1993?

Dr. JOHNSRUD. Arkansas has received $184,000 at this point in time. It is scheduled to receive $184,000 for fiscal year 1993.

Mr. DURBIN. Where is this work being carried out?

Dr. JOHNSRUD. The work on this project is being coordinated from the University of Arkansas campus in Little Rock. However, the actual programming efforts are taking place in conjunction with the 10 demonstration farms and in counties across the State.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. Since this is the first year of this project the accomplishments currently include the development of the 10 demon-

stration farms including their baseline data and an array of educational materials which will be used in the years ahead.

Mr. DURBIN. What is the estimated completion date of this program?

Dr. JOHNSRUD. The participants in this project have not indicated a completion date at this time.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr. JOHNSRUD. Since this project is just getting underway, it is difficult to document benefits at this time; however, the state of Arkansas could fund this type of work through the Smith-Lever 3b&c.

Keeping with the Administration's policy of awarding grants competitively, no further Federal funding is requested. If these programs are high priorities for the State, the State extension service could redirect existing funding to support the program.

INTEGRATED COW-CALF MANAGEMENT (IA)

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. The time period for this project is July 1, 1992 through June 30, 1993. This project has been underway for approximately 8 months. During this time period the project infrastructure has been under development. This includes the identification of participating beef cattle producers in an 11 county area in Southeastern Iowa. At this time, 27 cooperators have agreed to participate in this intensive effort. These cooperators will serve as focal points for education and demonstration efforts in the years ahead.

Mr. DURBIN. How much has been appropriated through fiscal year 1993?

Dr. JOHNSRUD. The project will receive $138,000 during the first year of operation. It is scheduled to receive an additional $138,000 for fiscal year 1993.

Mr. DURBIN. Where is this work being carried out?

Dr. JOHNSRUD. The work on this project is being coordinated from the Iowa State University Cooperative Extension county office in Fairfield, Iowa. The project area includes 11 counties in close proximity to Jefferson county, Iowa.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. The basic accomplishments during this 8 month time period include the identification of cooperating beef producers, development of resource inventories on these operations and development of educational materials which will be used in the years ahead. Linkages developed in concert with this effort include the involvement of the Farmers Home Administration, the Soil Conservation Service, Farm Credit Services, and Iowa Cattlemen's Association.

Mr. DURBIN. What is the estimated completion date of this program?

Dr. JOHNSRUD. The participants in this project have not indicated a completion date at this time.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr. JOHNSRUD. Since this project is getting underway, it is difficult to document benefits at this time.

Keeping with the Administration's policy of awarding grants competitively, no further Federal funding is requested. If these programs are high priorities for the State, the State extension service could redirect existing funding to support the program.

EXTENSION SPECIALIST (AR)

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. The South Central Family Farm Research Center at Booneville, AR, develops, refines and validates technology for family farm production systems which enhances economic efficiencies and product quality for the Ozark Highlands. The small farm management education program extends information on family farm management, financial management and marketing education to small family farmers in the target area. These efforts include planning, coordination and conduct of field days, in-service training, seminars and workshops in farm management, financial management and marketing. Information packets and enterprise budgets are developed for horticultural and forage crops. The Extension professional provides management information, demonstrates whole-farm management systems and coordinates with other agencies to aid the small family farmers.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JOHNSRUD. The project has been underway since 1990. The total Federal funding through fiscal year 1993 is $279,397.

Mr. DURBIN. Where is this work being carried out?

Dr. JOHNSRUD. The work is being conducted in South Central Arkansas. Field days have been conducted in Little Rock and Booneville, AR.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. A number of contacts have been made with clients on farm management and marketing issues. Educational activities have been conducted at field days, fairs, and with high school students. Informational requests have been met; and the specialist has interacted with various agencies and committees on competitiveness and profitability aspects of production of soybeans, pastures and forages, fruits, vegetables, and nuts.

Mr. DURBIN. What is the estimated completion date of this program?

Dr. JOHNSRUD. Funding for FY 1993 is expected to support the project through February 1994.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr. JOHNSRUD. Yes. Although the state of Arkansas could fund this type of work through the Smith-Lever 3b&c program.

RURAL ECONOMIC DEVELOPMENT THROUGH TOURISM (NEW MEXICO)

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. The Rural Economic Development Through Tourism (REDTT) Project is organized at the regional and county levels with the Cooperative Extension Service (CBS) of New Mexico State Univ. providing significant leadership at both levels. Several training and planning meetings have been held in the eight-county region. The interaction between CBS, community leaders and REDTT staff has been positive and productive. The period of the existing contract is April 1, 1993 to March 31, 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JOHNSRUD. This work has been underway since April 1, 1992 and $460,000 has been appropriated through fiscal year 1993.

Mr. DURBIN. Where is this work being carried out?

Dr. JOHNSRUD. This work is being carried out in an eight-county area in Southeastern New Mexico which includes Otero, Chaves, Dona Ana, Eddy and Lincoln counties; Lea, DeBaca and Sierra Counties were added recently.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. Regional Task Force meetings have been held in Ruidoso and Carlsbad, County Tourism Council Strategic Planning sessions in Capitan and Alamagordo, and Ag-Tour Planning meeting in Artesia and two Nut Festival Planning sessions in Alamagordo. Eight more meetings have been held in the area since Dec. 1; also, Tourism Resources Inventory Training sessions have been held in all three of the new counties brought in for the Year 2 program. Regional Task Force meetings, being held quarterly, convene Cooperative Extension representatives and community leaders from business, industry, education and government at the Federal, State and local levels. Each county will be submitting competitive grant proposals for project monies in the Year 2 budget (proposals due April 30, selections made May 15.) Training materials have been developed for the Rural Tourism Guidebook, a binder with phases providing step-by-step guidelines on how to plan, organize, implement and evaluate rural tourism initiatives; a hospitality training education program ("Catch the Enchanted Spirit") has also been developed and piloted and has been requested by several other communities. The first of a number regionally-focused products is a proposed regional marketing plan for the eight-county area. Two issues of a newsletter, "Newsline—New Mexico Tourism," have been published; circulation: about 1,000.

One community asked for, and received, technical assistance through REDTT to organize a two-county ag-tour incorporated into a holiday tourism promotion. The objective of the tour ("Holiday on the Pecos") was to promote ag products and provide a scenic one-day trip. Otero County likewise got technical assistance for organizing and evaluating its nut festival; vendors at the first festival said it was a worthwhile event they would participate in again.

An annual report has been written for Year 1 of REDTT and will be published and distributed April 18.

Mr. DURBIN. What is the estimated completion date of this program?

Dr. JOHNSRUD. The estimated completion date for this project is March 31, 1994.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr. JOHNSRUD. The benefits received from this project are expected to be worth the amount appropriated. This is to be a well-organized, basis model with goal supporting materials for County Extension Services all over the Nation to use in this relatively new held to Extension tourism development. Extension has no other appropriated funds dealing directly with the emerging program of rural tourism education.

Keeping with the Administration's policy of awarding grants competitively, no further Federal funding is requested. If these programs are high priorities for the State, the State extension service could redirect existing funding to support the program.

RURAL DEVELOPMENT IN NEBRASKA

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. The Cooperative Extension Service, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln, supports a small business information and technical assistance center which works with small-scale, independently owned businesses within the State of Nebraska. The activities of the Center were focused primarily on rural retail operations until 1992. Since this date, the major thrust of educational efforts and technical assistance has been directed to value-added processing of agricultural products and small agri-business firms. The current goals of the program include: stimulate the development of new food processing industries; assist existing firms to become more competitive; assist new and existing firms through educational programs developed for management and employees; and help commodity groups and state agencies in developing value-added export markets.

The existing cooperative agreement runs from October 1, 1992 through September 30, 1993.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JOHNSRUD. The project has been operating since October, 1978, and Federal appropriations began in 1988 and through 1992 totaled $1.54 million. For 1993, a total of $200,000 was appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JOHNSRUD. The project is based in Nebraska and supports the development of enterprises in that state.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. The earlier work of the Center tagged "Managing Mainstreet" conducted a total of 72 workshop series in 67 communities, attended by 1,341 business owners/managers and represented 642 businesses. The current thrust in entrepreneurship and

business development has successfully assisted the start up of 60+ new businesses in the state during the past two years.

Mr. DURBIN. What is the estimated completion date of this program?

Dr. JOHNSRUD. The current project and program development effort will be completed by September 30, 1993.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr. JOHNSRUD. The current special project has successfully demonstrated opportunities for adding new jobs and creating new firms through value-added processing of agricultural commodities. The effort has helped to develop new approaches for introducing small firms to export markets and identifying ways to enhance the competitiveness of small firms.

Keeping with the Administration's policy of awarding grants competitively, no further Federal funding is requested. If these programs are high priorities for the State, the State extension service could redirect existing funding to support the program.

RURAL REHABILITATION (GA)

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. The program has tested the feasibility of providing satellite-based adult literacy education, in association with vocational rehabilitation services, to handicapped adults in rural Georgia. The program has developed curriculum, tested and adapted technology, established student recruitment and retention strategies, expanded to Statewide coverage, and provided successful adult literacy education.

The existing grant contract on this program is effective through September 30, 1993.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JOHNSRUD. Funding for this program was initially appropriated in fiscal year 1989, and the program has been in operation since March 1989. Through fiscal year 1993, a total of $1,147,000 has been appropriated for this program.

Mr. DURBIN. Where is this work being carried out?

Dr. JOHNSRUD. This program is headquartered at the Center for Rehabilitation technology, College of Architecture, Georgia Institute of Technology, from which the literacy instruction is provided. The 81 classes at 74 adult literacy classroom sites, dispersed throughout the State of Georgia, include 23 technical schools, 11 adult learning centers, 13 elementary or secondary schools, 7 universities, 4 libraries, 1 correctional institute, 1 pool hall, 1 church, and 1 rehabilitation center.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. This program has demonstrated that satellite-based literacy training, in cooperation with vocational rehabilitation services, can successfully provide adult literacy education for handicapped rural adults. The program has served 1,560 students,

with approximately 70 percent expected to complete the full eight quarters of literacy education.

Mr. DURBIN. What is the estimated completion date of this program?

Dr. JOHNSRUD. Since the program is funded on a fiscal year basis, it will terminate on September 30, 1993.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr. JOHNSRUD. Yes. Keeping with the Administration's policy of awarding grants competitively, no further Federal funding is requested. If these programs are high priorities for the State, the State extension service could redirect existing funding to support the program.

RURAL EDUCATION (ND)

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. This project is designed to provide alternative career educational opportunities for displaced farmers, farm family members, and other rural North Dakota residents needing to pursue a new career without relocating, and to help establish a state-wide system to deliver distance learning education programs via telecommunications.

North Dakota has completed installation of a video and audio network linking ND University System classrooms across the State, the North Dakota Interactive Video Network (ND IVN), for distance learning and interactive video conferencing. The IVN includes 12 classrooms at ten System campuses and one meeting room in the State capitol in Bismarck. All are fully equipped and interconnected in the statewide network via fiber optic cable and high quality copper T1 telephone lines.

The existing grant contract on this project is effective through September 30, 1993.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JOHNSRUD. This project has been underway since May 1989, with funding initially appropriated in fiscal year 1991. The North Dakota IVN has been operational since September 1990. Through fiscal year 1993, a total of $4,244,000 has been appropriated for this program.

Mr. DURBIN. Where is this work being carried out?

Dr. JOHNSRUD. This is a cooperative project between North Dakota State University, Fargo, and the University of North Dakota, Grand Forks, and eight other North Dakota University System campuses. The NDSU Extension Service is the lead agency and has contracted with the UND Center for Rural Health for course preparation and delivery.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. The North Dakota Rural Health Distance Education Project offers credit courses in nursing, social work, and medical technology in classroom sites throughout the State. Currently, there are 58 students actively enrolled in medical technology class-

es; 20 students active in the nursing program; and the social work program has 30 active students, many of whom are moderate to low income single mothers employed full time during the day who could not attend classes without the program. Extension and other non-credit educational programs are also held on the IVN system and it has established, in cooperation with the Information Services Division of State government, the potential to serve State agencies, the public, and elementary and secondary schools throughout North Dakota with interactive video education programs.

This project also helped stimulate the appropriation of $700,000 State funds in the 1989–91 biennium and $1,350,000 in the 1991–93 biennium.

Mr. DURBIN. What is the estimated completion date of this program?

Dr. JOHNSRUD. September 30, 1993.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr JOHNSRUD. Yes. Keeping with the Administration's policy of awarding grants competitively, no further Federal funding is requested. If these programs are high priorities for the State, the State extension service could redirect existing funding to support the program.

RURAL HEALTH INFRASTRUCTURE (AL)

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. This is the second year of this "Public Policy Action Project—A Grassroots Approach to Improving Rural Health." The project consists of a coordinated effort to: (1) assess the health status and services of select rural counties; (2) assist the County Health Councils in leadership development and community organization; and (3) help rural communities strengthen their public policy-making skills to develop health policy options that reflect their particular socio-cultural needs and goals.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JOHNSRUD. This program received initial funding in fiscal year 1992, and a total of $400,000 has been appropriated through fiscal year 1993.

Mr. DURBIN. Where is the work being carried out?

Dr. JOHNSRUD. The work will be carried out jointly by the Alabama Cooperative Extension Service, Auburn University, and the School of Public Health, University of Alabama Birmingham.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. The project has conducted a state-wide health infrastructure policy education videoconference, has reinvigorated several existing county health councils, and begun the process of establishing additional health councils in interested and needy counties. The project has also demonstrated the potential for Cooperative Extension, the Medical School, and the State Health Department to collaborate in providing rural health leadership devel-

opment in needy rural counties. A Handbook has also been prepared on how to organize and establish county health councils, based on an in-depth study of successful councils operating in Alabama.

Mr. DURBIN. What is the estimated completion date of this program?

Dr. JOHNSRUD. This project is funded on an annual, fiscal year basis. Consequently, the program ends on September 30, 1993.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr. JOHNSRUD. Yes. Although the state of Alabama could fund this type of work through the Smith-Lever 3b&c program.

TECHNOLOGY TRANSFER PROJECTS (OK, MS)

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. The period of the existing contract is 10–1–90 to 9–30–93. The work involves the transfer of uncommercialized technologies from Federal laboratories and universities to rural businesses and communities. The objectives are to meet Congressional mandates under the Technology Transfer Acts of 1980 and 1986; to link Federal and university R&D with rural clients in business and government; and to create rural business, jobs, and product opportunities.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JOHNSRUD. This project has been funded since fiscal year 1984 and total funding has been $3,357,000.

Mr. DURBIN. Where is the work being carried out?

Dr. JOHNSRUD. The work is being carried out at Mississippi State University and at Oklahoma State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. Mississippi Extension Service has undertaken projects relating to local government education, small business and industry technologic, coordination and collaboration with federal laboratories, communications and networking, satellite video conferencing, CD–ROM technology, and crop modeling with expert systems are areas where some of the greatest successes have occurred. Mississippi Extension is set to launch a new five-year project to begin July 1, 1993 that focuses on INTERNET technology in collaboration with community colleges and county libraries. Continued efforts relating to GOSSYM-COMAX, the implementation of CD–ROM technolgy, networking, and assistance to small businesses and industries and continued educational efforts with local governments will continue through the use of these funds.

Oklahoma State Extension Service has worked with rural businesses and industry groups as well as local governments to identify priority technology needs. Working closely with both the Federal Lab Consortium and the Rural Enterprises group, means of addressing these priorities have been sought utilizing uncommercialized technologies developed through Federal research and development, and made available through Extension's educational delivery

system. Specific programs provide assistance to small food processors enabling them to improve and expand their competitive advantage. Emphasis is also placed on helping small industries to deal with environmental and waste issues, with a focus on implementing storm water regulations promulgated under the revised Clean Water Act.

Mr. DURBIN. What is the estimated completion date of this program?

Dr. JOHNSRUD. Since these projects are funded on an annual basis, we usually estimate the completion date for the end of the fiscal year.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr. JOHNSRUD. Yes, the benefits are worth the amount appropriated. Keeping with the Administration's policy of awarding grants competitively, no further Federal funding is requested. If these programs are high priorities for the State, the State extension service could redirect existing funding to support the program.

PROJECT FUTURE (MN)

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. The period of the existing contract is 10–1–90 to 9–30–93. The work involves development of an educational program that will assist communities in analyzing and assessing the status of housing, business retention and expansion programs, and school services and facilities and in proposing alternative approaches that remedy problems in these areas.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JOHNSRUD. Work has been underway since FY 1989 and $855,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JOHNSRUD. The work is being carried out by University of Minnesota Extension Service.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. Minnesota Extension has developed a series of models of multi-community programming; has expanded the program into Central and North Central Minnesota; has developed videos for training citizens and faculty in the self-renewal program; has developed manuals for vision based community development; and has distributed sets of training materials to those interested in community development.

Mr. DURBIN. What is the estimated completion date of this program?

Dr. JOHNSRUD. Since these projects are funded on an annual basis, we usually estimate the completion date for the end of the fiscal year.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr. JOHNSRUD. Yes. The benefits are worth the amount appropriated. However, the state of Minnesota could fund this kind of work through the Smith-Lever 3b&c program.

RURAL DEVELOPMENT (OK)

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. The period of this contract is 10-1-90 to 9-30-93. This is a technology-based economic development program that seeks to promote job growth, business development, and rural entrepreneurship through business assistance, technical assistance, business incubators, and a new business financing. Commercial product fairs are held each year showcasing inventions by entrepreneurs from rural areas.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JOHNSRUD. This project has been underway since FY 1987 and $2,684,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JOHNSRUD. This work is being carried out at Rural Enterprises, Durant, Oklahoma.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. Rural Enterprises (RE) operates an economic development program in a 25 county region in Southeast Oklahoma. The spectrum of services offered by RE has resulted in incubator programs serving numerous rural businesses, a New Product and Process Fair for rural entrepreneurs, financial loan packaging services in support of job creation, and identification of new technologies for improved efficiency or new products.

Mr. DURBIN. What is the estimated completion date of this program?

Dr. JOHNSRUD. Since these projects are funded on an annual basis, we usually estimate the completion date for the end of the fiscal year.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr. JOHNSRUD. Yes. The benefits are worth the amount appropriated. Keeping with the Administration's policy of awarding grants competitively, no further Federal funding is requested. If these programs are high priorities for the State, the State extension service could redirect existing funding to support the program.

MANUFACTURING TECHNOLOGY TRANSFER PROGRAM (WI)

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. The period of the existing contract is 10-1-91 to 9-30-93. This project involves support for economic development in Wisconsin through direct assistance to manufacturers. The assistance takes the form of consultation to solve organizational, managerial, and technological problems through the application of improved technology.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JOHNSRUD. The project began in FY 92 and total funding thus far is $330,000.

Mr. DURBIN. Where is the work being carried out?

Dr. JOHNSRUD. The work is being carried out at the University of Wisconsin-Stout.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. The project has been operational for one and one-half year and has worked to revitalize 20 manufacturing companies across the state. Through on-site assistance, MTT helps these companies position themselves to meet the demands of world-class manufacturing in a global economy. In 1991, the program received the Wisconsin Economic Development Association's (WEDA) Project of the Year Award, and the Technology Transfer Project of the Year Award from the National Association of Management and Technical Assistance Centers (NAMTAC). In February, 1992 MTT's project with Barko Hydraulics in Superior, Wisconsin, received a Special Award for University/Industry Interaction from Wisconsin Manufacturers and Commerce (WMC).

Mr. DURBIN. What is the estimated completion date of this program?

Dr. JOHNSRUD. Since these projects are funded on an annual basis, we usually estimate the completion date for the end of the fiscal year.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr. JOHNSRUD. Yes. The benefits are worth the amount appropriated. Keeping with the Administration's policy of awarding grants competitively, no further Federal funding is requested. If these programs are high priorities for the State, the State extension service could redirect existing funding to support the program.

AMERICAN PACIFIC-HAWAII

Mr. DURBIN. Describe the work that has been done under this program to date and the period of the existing contract.

Dr. JOHNSRUD. The project is currently organized into five areas of emphasis: staff development, crop protection, communication/database development, marketing and agroforestry/environmental education. A task force of each area, made up of representatives of each institution and a Director as chair, provides program advice by assessing needs; reviewing proposals and recommending activities to be funded under ADAP. Directors meet to consider these recommendations and improve annual plans of work. Most activities are carried out by Land Grant staff, with occasional outside assistance, as needed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JOHNSRUD. This project was initially funded in fiscal year 1988. The amount of appropriations since that time has totaled $3.8 million.

Mr. DURBIN. Where is the work being carried out?

Dr. JOHNSRUD. The project was awarded to Hawaii for coordination and benefit of the territories.

Mr. DURBIN. What has been accomplished to date?

Dr. JOHNSRUD. We have greatly improved communications within the region by establishing a computer-assisted communications network which links all five land-grant institutions in a bulletin board system. Additionally, there has been an emphasis on staff development in order to ensure the retention of staff and the development of the program. Key aspects of the program include: crop protection research, database development, and instruction in marketing skills appropriate for the Pacific Island markets.

Mr. DURBIN. What is the estimated completion date of this program?

Dr. JOHNSRUD. The estimated completion date is May, 1994.

Mr. DURBIN. Are the benefits received from this project worth the amount appropriated? Could these benefits be achieved through other programs?

Dr. JOHNSRUD. Yes. Keeping with the Administration's policy of awarding grants competitively, no further Federal funding is requested. If these programs are high priorities for the State, the State extension service could redirect existing funding to support the program.

FEDERAL ADMINISTRATION

Mr. DURBIN. Would you please update both tables that appear on page 601 of last year's hearing record to reflect fiscal year 1992 actuals?

Dr. JOHNSRUD. I will update that for the record.

[The information follows:]

Extension Service Sources of Federal Administration

[Dollars in thousands]

Program:	*1992*
Smith-Lever 3(b&c)	$6,667
1890's & Tuskegee University	989
D.C. Extension	40
1890 Facilities	380
Federal Administration, (direct)	5,978
Other Program set-asides	2,552
Total	16,606

Extension Service Object Classification

[Dollars in thousands]

Object class:	*1992*
Personnel Compensation:	
Salaries	$10,279
Benefits	1,789
Subtotal	12,068
Other Object Classes:	
Travel	792
Transportation of Things	34
Communications Utilities, and other rent	823
Printing	423
Other Services	1,882
Supplies and Materials	400
Equipment	504
Grants, subsidies and contributions	403,878
Total	420,804

Mr. DURBIN. Were any grants or contracts issued by Extension out of your discretionary funds in fiscal year 1992 or to date for fiscal year 1993?

Dr. JOHNSRUD. In fiscal year 1992, $248,000 in discretionary funds was approved for Special Projects grants. An example was $80,000 for the Los Angeles Project to help rebuild the city after the riots. Additionally in fiscal year 1992, the Extension Service had a $400,000 contract for an evaluation of the Youth at Risk program, and a $50,000 contract for Classification Standards for Extension National Program Leaders. So far, in fiscal year 1993 approximately $160,000 in Special Project grants are pending.

4-H ENROLLMENT

Mr. DURBIN. Please update the table that appears on page 603 of last year's hearing record showing both rural and urban 4-H enrollment to include fiscal year 1992 actuals and fiscal year 1993 estimates.

Dr. JOHNSRUD. 4-H enrollments for the past five years show a steady annual increase in youth participation from urban areas with an increase shown in rural areas in four of the five years. Declines in rural participants this year were not quite offset by increases in urban participants, resulting in an overall decline of 13,372 participants or two-tenths of one percent (.2%). Currently, 47.3% of participants are from rural areas and 52.7% from urban areas. While State enrollment summaries for fiscal year 1993 will not be sent to us until this coming November, we would predict continuing small increases in urban participants and a relatively stable overall 4-H enrollment. I will update the table for the record.

[The information follows:]

NATIONAL 4-H ENROLLMENT BY RESIDENCE

Year	Rural	Urban	Total
1988	2,475,249	2,421,968	4,892,217
1989	2,680,584	2,464,964	5,145,548
1990	2,710,612	2,723,674	5,434,286
1991	2,763,652	2,894,005	5,657,657
1992	2,671,389	2,972,996	5,644,385

HOME ECONOMICS

Mr. DURBIN. How much of the fiscal year 1992 Smith-Lever funds and how much of the Federal Administration funds were devoted to the area of Home Economics and how much will be devoted in fiscal year 1993?

Dr. JOHNSRUD. I will provide that for the record.

[The information follows:]

HOME ECONOMICS

[Dollars in millions]

	1992	1993
Smith-Lever	$88.9	$92.4
Federal Adminstration	2.3	2.3

AFRICANIZED HONEYBEE

Mr. DURBIN. Your agency funded a special project with Texas A&M to develop and provide educational materials on the arrival of the Africanized honeybee for school programs in the southern region of Texas. Was this project successful and has it been expanded to other regions of Texas and to additional states?

Dr. JOHNSRUD. Texas was the first state to deal with the arrival and establishment of the Africanized honeybee (AHB) in the Rio Grande Valley, ES–USDA contributed over $50,000 to help develop and provide English and Spanish school programs in the southern region of Texas. These Federal dollars were matched by State appropriations in Texas. Prior to this project, only incidental pieces of information were available on the behavior of the Africanized honeybee (AHB).

An authentic bee trap box was used as a packing container for a short video, a slide set, large photos, honey bee specimens, and other support materials. The kit included a teaching outline for use by the instructor. Additionally, public service announcements, posters, and other educational materials were developed. Today, the kit is still the main source of teaching information for grade school children in ares that are Africanized and are to be Africanized. By all standards, the materials are considered to be successful and useful. The materials were high quality and professionally developed.

In addition to school uses, a major use of the materials has been by CES county agents in responding to the public's request for information. As the AHB has colonized new counties, the materials were used to address educational needs in those counties. The use of the kit was always just ahead of the arrival of the AHB. Presently, the materials are used extensively across South Texas and are available over the entire state.

Since Texas had to deal with the AHB first, they had the unique challenge of developing all plans, regulatory procedures, and educational materials for the first time. In doing so, Texas A&M has developed materials that have been copied/duplicated across the United States. Texas A&M agreed to develop educational materials in such a way that they could be used in other states. The materials are in New Mexico, Arizona, and California. Having been widely publicized, the materials are probably scattered across the United States.

This was an excellent program and, for the money, has been invaluable as states develop regulatory and educational programs.

NATURAL RESOURCES EDUCATION PROGRAMS

Mr. DURBIN. Describe some natural resources education programs. How beneficial are these programs?

Dr. JOHNSRUD. The overall objective of Extension's renewable natural resources programs is to provide research-based education that enables owners, users, and the public to better protect and enhance the environment on millions of acres of privately-owned renewable resource lands, thus strengthening the Nation's renewable resource base. Extension's renewable resources education programs are partially funded by the Renewable Resources Extension Act (RREA). These programs are aimed at owners, managers, and users of renewable resource lands and at those who advise them. Specific issues to be addressed are identified by that state, and vary according to its needs. Five specific objectives are: renewable resources production; environmental enhancement; improved utilization of natural resources; environmental education for the public; and continuing education for professionals. Some specific audiences are: landowners and users; resource-based industries; communities and decision-makers; the public (including youth); and natural resource professionals.

Educational programs present research-based information to assist these audiences as they engage in their renewable resource activities. For example, forest and range landowners learn how to increase profitability and productivity while preserving and enhancing the land's environmental values, wildlife habitats, riparian areas and wetlands, and diversity. Resource-based industries learn how to adopt new technology to improve productivity, increase efficiency, and reduce adverse environmental impacts.

Communities are able to develop more sustainable economies based on renewable natural resources, and some elect to use trees in urban areas to improve quality of life. Individuals, including youth, become better informed about renewable resource principles, so that they can act as responsible users and stewards of renewable resource lands and products. Natural resource professionals update their knowledge of current technology, and improve their skills in resolving renewable natural resource conflicts.

Some cumulative benefits from these programs for the years 1989, 1990, and 1991 are:

Nearly 1.2 million owners improved the management of 50 million acres of renewable resource lands as a direct result of RREA programs; thus increasing their savings, earnings, or anticipated future earnings by $670 million; wood industry firms saved $28 million through learning how to adopt improved practices; sixty-eight thousand professionals increased their knowledge which enabled them to favorably impact the resources that they influence, or the persons they instruct; fish and wildlife habitat was improved on 101 million acres; eight million acres were protected from wildlife damage; and sixty-three million acres of rangeland was better managed as a result of education programs for ranchers.

Most recently Extension's educational programs in natural resources have focused on forest stewardship and urban forestry. Extension provides the educational lead for USDA to place an additional 25 million acres of non-industrial private forest lands under

management by 1995, and to plant a billion trees a year in urban and rural areas through the decade of the 90's. Specific educational examples include: fundamentals of Forest Stewardship Planning; forest Wildlife Habitat Enhancement Workshops; forest Stewardship Practices for Wetlands, and Riparian Zones; fire as a Forest Management Tool; silviculture and Ecology for Loggers; forest Landowner Timber Taxation Workshops; forest Stewardship at the Rural/Urban Interface; and forest Ecology for Builders and Developers.

An analysis of State Extension accomplishment reports provides the following information on Extension's educational programs in natural resources. These are annual benefits: 400,000 private non-industrial forest landowner contacts; 21 million acres of improved forest land management, $160 million of increased revenue from forestry and wildlife management practices, 23,000 forest industry worker assist, 1,600 wood processor assist, $48 million is savings through improved forest industry efficiency, 100,000 contact hours of continuing education training to 25,000 natural resource professionals, and 50,000 teachers trained in environmental science.

A special, three year pilot program, initiated by Extension in FY 92 is Silviculture Education for Loggers. Labeled as Logger Education to Advance Professionalism (LEAP) the program graduated one hundred fifty two loggers, in three states, in the inaugural year. The programs were jointly conducted by Extension and its many public and private forestry community partners. Two of the pilot states awarded the loggers with Master Logger Certificates. These state are using the graduates as early adopters of new technology and legitimizers of education as a means of advancing logger professionalism. The pilot project is being continued in FY 93 in the three original states and five others.

In-depth evaluations of these programs indicate that loggers are receptive to training in forest ecology and silviculture. The evaluations also reveal that loggers are willing to adopt new harvesting methods once informed of procedures and technologies. These results allow Extension to forecast improved logger skills and competencies leading to heightened concern for long term site productivity, and reduced degradation of forest ecosystems.

NEW GRANT PROGRAMS

Mr. Durbin. In your statement you mentioned that three new grant programs were initiated in fiscal year 1993. Briefly describe each of these programs, including its goal, how many grants will be awarded, the cost of each grant, cost-sharing requirements, etc.

Dr. Johnsrud. The three programs are the Rural Health and Safety Education Project, Rural Technology Grants and Outreach and Assistance to Socially Disadvantaged Farmers and Ranchers Grants.

The Rural Health and Safety Education appropriation was used in a Federal-State partnership operated jointly by the Extension Service/USDA and the Mississippi Community College Foundation in cooperation with the Cooperative Extension Service of Mississippi State University, the National Rural Life Center, and the Rural

America Partnership Program. The project objective is to develop training programs for rural health care providers.

The Rural Technology Grants which will be announced, through the Federal Register are for the purpose of funding a grant or grants from qualified organizations that would establish, and operate centers for rural cooperative development.

The Socially Disadvantaged Farmers Program authorized by Section 2501 of the 1990 FACT Act, consists of competitive grants to be awarded to assist eligible organizations and institutions to provide outreach and technical assistance to encourage and assist socially disadvantaged farmers and ranchers to own and operate farms and ranches and to participate in agricultural programs.

The Rural Technology Grant and the Outreach and Assistance for Socially Disadvantaged Farmers program are in the implementation stage. Proposals will need to be submitted by eligible recipients and reviewed before the accomplishments and benefits of the programs are known. There are no-cost sharing requirements included in these programs.

Mr. DURBIN. Mr. Skeen?

FEDERAL/STATE RELATIONSHIP

Mr. SKEEN. I know it is a cooperative agreement between the Federal Government and the States on the Extension Service, but we are losing agents in the field because of lack of funding for cost of living.

Your budget last year didn't reflect that. That is probably not your area of responsibility, cost-of-living pass-throughs to personnel in field offices. Is that a correct assumption?

Dr. JOHNSRUD. Within our Federal appropriations, the majority of funds are the Smith-Lever 3-B and 3-C. That is the largest chunk of dollars that is matched by the State appropriations. Those dollars, federally, have not kept up to the cost of doing business. Compound that with difficult situations in some States and the end result is what you are describing.

Mr. SKEEN. We have had discussions about who is responsible for the loss of agents in the field and we are being hit with it constantly. When I go back to the district, folks say "It is the Feds fault or State's fault," and I want to get it clear.

You have had a change of mission, more societal and less concern about the infrastructure of the Extension Service System, is that a correct assumption; like the Youth at Risk programs?

Dr. JOHNSRUD. The whole agenda changed. We are trying to focus more sharply on whatever those societal issues are that are within our mission. The Youth program has always been within our mission.

Mr. SKEEN. No matter what the name was?

Dr. JOHNSRUD. We still have the 4-H program.

Mr. SKEEN. Now we have Youth at Risk.

Dr. JOHNSRUD. That is a particularly targeted program for those kids—

Mr. SKEEN. I understand.

Dr. JOHNSRUD. The purchasing power of the Federal dollars does not equal the cost of doing business. It so happens in many States

now that some of their appropriations have not equaled the cost of doing business. That is what we are running into.

Mr. SKEEN. It has been a coexistent problem.

Dr. JOHNSRUD. Yes, sir. Particularly in the last three or four years.

Mr. SKEEN. Do you foresee this improving?

Dr. JOHNSRUD. We know what drives dollars that are available for folks like you to work with. The economy needs more zip.

Mr. SKEEN. If you have a program and a message that you are sending to the folks, the Extension Service is based on the premise that you are delivering the kind of help and the kind of work that you do depends a lot on field work.

Dr. JOHNSRUD. Absolutely, yes. You have to get where the customer is and that is what the field offices are, the real strength of it.

CONSOLIDATION OF FIELD OFFICES

Mr. SKEEN. Rearranging field offices is a great idea in some places. We have field offices in the District of Columbia and so forth. Yet, we are very sensitive to it in rural areas, particularly when you talk about consolidating.

Where you have multiplicity representation of agencies in one office complex and one agency wants to remove them by, combining the offices, yet they are going to leave one agency there and move another 200 miles away. I hope that you take this into consideration before you make a judgment as to what the makeup of the particular areas should be.

Dr. JOHNSRUD. If I may reemphasize, we have been a part of that team. The Extension Service local offices are not USDA offices. They are created by the State Land-Grant Universities and local authorities.

As you know, they are heavily supported by county government. These offices are not a part of those that USDA has the decision to say they go or don't go. That has to be a State decision.

Mr. SKEEN. But if the Federal Government works on a different criteria it also affects the State's judgment—that is what I am getting at.

Dr. JOHNSRUD. Yes, sir.

Mr. SKEEN. I hope there is care and consideration given to that aspect of the problem.

Dr. JOHNSRUD. At the State level, the USDA leaders of those agencies work in concert with the State Extension Directors, and those are part of the Food and Agricultural councils in the State that makes this decision.

Mr. SKEEN. Thank you. I appreciate your concern.

Mr. DURBIN. Mr. Peterson?

EXTENSION'S MISSION

Mr. PETERSON. Thank you, Mr. Chairman.

As a follow-on to earlier questions, I must say that my county couldn't do without the service. They have done a magnificent job over the years.

The question I have on consolidation relates to the mission changes that are taking place within USDA. Specifically I am interested in looking at areas which your agency traditionally has been responsible for but perhaps may no longer be required. Have we looked at it from the standpoints of why are we doing these activities and are they necessary?

Dr. JOHNSRUD. That is sort of a constant. Missions are kind of general. It is those programs within the mission that you really decide where you allocate your resources. We are constantly looking at this as a system, where we put our priorities.

They may be a little different in Dade County Florida than they are in central New Mexico. That is the kind of strength of the system that we are talking about today. You decide locally how you want to put resources together and what issues are really biting at the people there.

We try to function as a good partner between the Federal and the State, but you have to let the power of people help decide what is really important in north Florida versus south Florida and how do they really want to structure their office and what ought to be the focus.

Some have said that we probably aren't giving as much attention to production agriculture as we used to. We are giving even more than we were 10 years ago, but what we are doing is different.

I talked to dairy producers in the north part of your State. How they fix up their rations is not as important as how they handle their waste management. Your State Extension Service is working with them on waste management.

That issue in Florida for the dairy producers, is bigger than for dairy producers in some states out in the Midwest. There are things we are doing in one State we aren't doing in another because of the issues.

YOUTH AT RISK

Mr. PETERSON. The Youth at Risk programs are absolutely fantastic, but there are a lot of other people doing this. Are you marrying up with them, are you augmenting their activities?

I don't know why we have so many agencies all doing the same thing and then sometimes having turf battles.

Dr. JOHNSRUD. That is an excellent question and I would have highlighted that in the beginning if I had a few more minutes. We have joined hands at the national and State level and the local level with Justice, Health and Human Services, and HUD, and I am talking about those Agencies as active partners at the ground level. We can bring things to the table they can't and they can bring things to the table we can't. Working with HUD is a great partnership.

I would have to say that we are really getting more out of each of our resources and we are not walking on each others toes. I have personally visited several sites in Youth at Risk to look at that. When you get into a site we don't wear different caps. It works better in some places than others, but when we went into this program we said it has to be high collaboration.

We can't do it alone and be effective. No way. It is more than just what we do; it is a whole set of infrastructure agency relationships. So we try to make these good linkages here so it spin-offs and supports it at the local level.

The Justice Department has been a great partner.

COMPUTER/ELECTRIC TECHNOLOGY

Mr. PETERSON. I applaud that. I might ask you or one of your colleagues to come over and talk about that specific program at some juncture because I am very interested in it.

It is no longer possible for a farmer to go in on the back of an envelope and go to his banker and say "I have a really good deal here," and do his thing. Therefore, have you focused on computer literacy in the agricultural areas and helped farmers to resolve some of the "spread sheet" problem they have had over the years?

Dr. JOHNSRUD. Yes; two things. First, the rather disturbing and difficult times of the mid–1980s when we had what was called the farm crisis. That was the first time that we extensively used the power of the computer to help us work with farmers on an one-on-one analysis basis.

We have had training courses in States on how to become computer literate. We are doing some software development for our own use internally and some has been pretty good and some cumbersome.

Second, in my opening comments I said we are looking into the whole infrastructure of database. That is going to be an avenue for the clientele to enter a whole new world where you can look at the research knowledge, whether in France or England or the U.S. That is a capacity that exists.

It is interesting, that the young folk in the Youth at Risk program are heavily using it there because they come with that interest. In the Youth at Risk program in Los Angeles, one of the things they have in that program is a computer. They are using it to teach math and science skills in these youth at risk sessions.

Mr. PETERSON. I applaud you. At some juncture I would like to pursue that further.

Dr. JOHNSRUD. We will.

Mr. DURBAN. Mr. Myers?

MATCHING REQUIREMENTS

Mr. MYERS. The Extension Service has matching requirements for states who seek grants from "Initiative" funds. These matching requirements were not part of the authorizing or appropriating legislation. What are the reasons for these matching requirements?

Dr. JOHNSRUD. The matching requirements for several of the earnmarked funds addressing National Initiatives were mutually agreed upon between the Federal and State partners within the Cooperative Extension System on the basis that a solid commitment can be formed if all partners contribute to the project. The matching requirement has a foundation in the Smith-Lever legislation.

Mr. MYERS. Are you concerned that these requirements will result in only the most affluent states and counties being able to apply for these funds?

Dr. JOHNSRUD. No. The responses to the request for proposals for these targeted programs have consistently come from all State Extension Services. I cannot recall a state not applying for funds based solely on a concern about matching requirements.

Mr. MYERS. With the matching requirements in place, how do you ensure that the states with the greatest need receive the funds?

Dr. JOHNSRUD. We do not have any evidence that States are not receiving requested funds due to the matching requirement. We try to insure that all states receive either targeted funds or funds for the Base programs that address these critical issues. Those states that demonstrate a great need for a specific program and submit a project proposal will, most likely, receive additional funding.

FARM SAFETY

Mr. MYERS. The Farm Safety Program has been successful in the few years since its inception. Do you foresee adding additional states to the program in the next year?

Dr. JOHNSRUD. There are two components to the Farm Safety 3(d) line item appropriations. The first component in the amount of $970,000 for fiscal year 1993 is being used to partially fund farm safety injury and illness prevention programs in each of the 50 states and Puerto Rico. Each State Extension Service receives $19,019. The second component in the amount of $1,750,000 for fiscal year 1993 is being used to fund education and assistance programs for farmers with disabilities the AgrAbility Projects in 16 states.

RURAL HEALTH CARE

Mr. MYERS. How involved is the Extension Service in providing information on health care and communicable disease in rural America?

Dr. JOHNSRUD. Extension, over the years, has been teaching people to practice healthy life style behaviors, to participate in local health screening fairs, and to have recommended inoculations throughout the life cycle. It has been working with local decision makers, health care providers and community residents in the formation of local health councils/coalitions to address community health related needs such as the recruitment of physicians, providing transportation to health facilities, publicizing the availability and the process for using the health services available.

In October 1992, Extension's impetus was increased when a new national initiative, "Decisions for Health," was adopted and increased efforts are being committed to health education, health promotion and community health services.

Some examples of Extension's programs are:

A Healthy Families Project was initiated in Iowa to improve the diet, nutrition and health of family members and to reduce the risks for chronic health problems. The first phase included the organizing of community wellness councils in 34 counties. These councils supported healthy family lifestyles efforts by sponsoring classes and family activities, providing videotapes and other educational resources, establishing olympic style

sports events and monitoring programs. Over 1,057 participants reported the adoption of healthier lifestyles such as increased exercise, followed Dietary Guidelines, increased use of seat belts and child seats and quite smoking. Some communities provided facilities for exercising.

Kansas State University Extension has initiated a major rural mental health education program for farm families. A focus is on reducing depression and stresses caused by transitions in rural areas. Domestic violence, drug abuse and other abusive behaviors are addressed in educational programs that are conducted by Extension in partnership with mental health staff members.

Indiana has had a major emphasis in most of its countries on "Have a Healthy Baby." Typically 6.6 percent of Indiana births have low birth weights. Low birth weights have been reduced to 2.2 percent among the 2,086 pregnant teens and young women who have participated in this educational effort. For every dollar spent Indiana estimated that twenty dollars are saved or a total of three million dollars—60 to 70 percent of which would have been medicaid payments. This effort in being coordinated with WIC, March of Dimes, Kiawanis, local United Ways, school principals and teachers, hospitals and others.

The Extension Service and the Health Department in Pulaski County, Missouri formed a community-based elderly rural health issues coalition to provide educational programs, resources and services for senior citizens. The first community service that the coalition sponsored was a health fair that included screening, medical counseling and physician referrals. An Area Rural Health Coalition was formed in Sedalia by Extension. The coalition reviewed the health curriculum in all Pettis County Schools and found weal curriculums in rural public and private schools. The coalition met with several rural school officials and proposed ways to strengthen the curriculum.

In Connecticut, 11 volunteers were trained to teach a series of six sessions to pregnant women as a part of the Healthy Mothers Healthy Babies program that reached 647 women.

The Mississippi CES, the Mississippi State Department of Health and the Freedom from Hunger Foundation (in Davis, CA) have formed a partnership in 5 Delta counties. The overall objectives of the partnership are to reduce the risks associated with low birth weight and to reduce infant mortality. An education program was conducted that included health, food and nutrition, and parenting skills. Another segment of the program was designed to increase the participants' use of existing health care and social services and increase their participation in community nutrition programs. Annually, 800 to 1000 pregnant women have participated in the program.

In Alabama the "Today's Mom" program is a mature 20-year old program that teaches nutrition, food safety and substance abuse consequences to pregnant teen-age women. In 1991, over 4,100 were enrolled in the program.

Many North Carolina county Extension offices organized health screening/health education events in cooperation with local health departments. A mobile unit was used by 30 counties as a part of these education programs. Participants were invited to follow-up activities that included individual computerized diet analyses and consultations, lunch and learn programs, CVD and healthy lifestyle programs. A 15-week weight control series, Noonliting, was conducted in 45 counties that reached over 4,100 people at worksites. As part of the evaluation, 377 adults were screened for blood cholesterol levels and more than two-thirds had levels higher that 200 mg/dl. These people receive information on heart-healthy eating and other relevant subjects.

Mr. MYERS. Does the Extension System coordinate with other agencies?

Dr. JOHNSRUD. Yes, at the national, State and local levels the Cooperative Extension System works with private organizations such as: March of Dimes; Healthy Mothers Healthy Babies Coalitions; United Way; State and Area Agencies on Aging; School Boards; Principals and Teachers; Hospitals; Kiwanis International; NACo; Senior Centers; the National Rural Health Association; American Society on Aging; Safe Kids Campaign Coalitions; Easter Seal Society; National Safety Council; Chambers of Commerce; National Rural Electric Cooperatives Association; and the Governor's Highway Safety Representatives. Additionally, Extension is working with public agencies, which include other USDA agencies, the Department of Transportation, Health and Human Services, and public health departments, including mental health departments.

The purpose of coordinating and networking is to maximize outreach to more people, to enhance the quality of programs, and to prevent duplication of effort.

USDA REORGANIZATION

Mr. MYERS. Please describe what impact the proposed USDA field reorganization will have on the Extension Service. Will county agents be combined with ASCS and FmHA offices? Please explain.

Dr. JOHNSRUD. Currently, the State Extension Services are collocated with USDA agencies, such as ASCS, SCS, or Farmers Home, in about 500 sites. If any of these sites were affected by relocation or consolidation of the USDA agencies, it is estimated that about 10% of the Extension offices would also make changes in their location. However, the State Extension field offices are not USDA controlled. The decision to relocate or consolidate is a State decision.

Mr. MYERS. The mission of the Extension Service is to draw from research and pass on the information to the American public, particularly in rural America. How would a proposal to place the Extension Service under the jurisdiction of the Under Secretary for Farm Programs rather that the Assistant Secretary for Science, Education and Economics impact this mission?

Dr. JOHNSRUD. The impact of Extension Service being placed under the Under Secretary for farm programs or other structional

arrangement within a revised USDA structure is probably minimal if the educational mission of the Agency and the Federal presence within the Cooperative Extension System are not changed.

Extension has a long history of working effectively with a wide range of organizations, within the Science and Education area, other Federal agencies and entities outside of the Federal government to obtain and transfer new information. We anticipate that these relationships would continue whether or not Extension was organized within the Science and Education area.

Mr. DURBIN. Ms. Kaptur, a member of the Subcommittee has some questions she would like answered for the record.

[The questions and responses follow:]

Ms. KAPTUR. How will Extension work with the Sustainable Agriculture Research and Education (SARE) program and with CSRS in administering the training and outreach program? Can we be assured that the same partnership approach—joining farmers, government, universities, agricultural businesses, and non-profit organizations together in consensus decision-making—will be utilized? Can we be assured that farmer participation will be stressed in all aspects of the program? Will the SARE committees and infrastructure be utilized to implement this program to ensure coordination and minimize any unnecessary redundancies?

Response. Extension Service-USDA (ES) has fully complied with the legislative language to work in close cooperation with the Cooperative State Research Service in implementing Chapter 1 of the Sustainable Agriculture Research and Education Subtitle of the 1990 FACT Act. Extension staff have been project coordinators or major participants in over 70 percent of the projects funded through the CSRS appropriations pertaining to SARE.

This close collaboration has continued as the Cooperative Extension System has made significant progress in the development and delivery of education and demonstration programs addressing sustainable agriculture. Approximately one-third of the States now have sustainable agriculture initiative teams that involve both public and private sector research and education organizations, farmers, ranchers, and other interested groups in the planning and development of the Extension programs.

Ms. KAPTUR. To what extent will this program aid in the mission to "reinvent government?" Will it play an increasingly prominent role in the Extension's future plans and goals?

Response. One of the concerns that the "reinventing government" emphasis tries to address is that industrial-era governments with large, centralized bureaucracies and standardized services to not meet the challenges of the rapidly changing information society and knowledge based economy. The Cooperative Extension System, with its partnership at the Federal, State and local levels reflects a mission and program that has been meeting this challenge for over seven decades.

Extension involves its clientele in the design of programs and the use of public funds to meet the needs of the public in addressing critical issues. The partnership does not allow for "top-down bureaucratic decisions". Our educational Base Programs continue because they are still relevant to each States' clienteles priorities. The National Initiatives that arise from the Base Programs to receive special attention and resources, are the result of the public telling Extension what it needs to solve their problems. These programs are tailored to site specific needs. This collaboration and partnership is the foundation of Extension work in this country, and will continue to be a prominent keystone for the Cooperative Extension System.

Mr. DURBIN. I want to thank the panel for joining us. We will be back in touch with you as we work on the appropriations for the next fiscal year.

[The statement of Dr. Johnsrud follows:]

EXTENSION SERVICE

Statement of Dr. Myron D. Johnsrud, Administrator, Extension Service, before the House Appropriations Subcommittee on Agriculture, Rural Development, Food and Drug Administration, and Related Agencies.

Mr. Chairman and members of the Committee, I appreciate the opportunity to again appear before you to discuss the status and programs of the Extension Service and the ongoing cooperative partnership with the Land-Grant Universities and local Extension offices nationwide that comprise the Cooperative Extension System.

In testifying today I want to emphasize at the outset that the Administration is currently formulating the President's FY 1994 Budget. Accordingly, I am not in a position to provide you with the Administration's position on funding for specific programs or activities. As soon as the President's FY 1994 Budget is released I would be pleased to provide you with the Department's views.

This summer I will reach my seventh year as Administrator of the Extension Service-USDA. During that time, with the assistance of the Executive Branch and the guidance of Congress, the nationwide Extension system has been building a firm foundation as a dynamic national educational network for the 21st Century. The anchors of this foundation are "issues programming" and "strategic planning".

In the mid 1980's, the Extension System was challenged by the Executive Branch to prove its worth to the American public, in its traditional arena of agriculture, as well as addressing other societal problems, towards which Extension conducts educational programs. The Extension System responded to this challenge with a commitment to addressing important societal issues through the establishment of National Initiatives. These Initiatives are the current, most significant and complex issues on which the Extension System can make a difference.

Current National Initiatives include:

- Communities in Economic Transition
- Decisions for Health
- Food Safety and Quality
- Plight of Young Children
- Sustainable Agriculture
- Waste Management
- Water Quality
- Youth at Risk

The Cooperative Extension System has recognized the need to systematically allocate educational program resources to these current and emerging issues. We are using a strategic planning process and a systems method to program development, delivery and evaluation. Through issues programming, the Extension System identifies and addresses the critical concerns of Americans.

By focusing on the critical issues of our nation, as well as realigning Extension educational base programs into a set of dynamic, changing, results-oriented programs, the System has reallocated and received significant resources on the national, state and local levels. The $424 million Federal appropriation provided by Congress for 1993 is the base that generates over $900 million from the States and local governments and the private sector.

However, while the total resources of over $1.4 billion reflects a healthy nationwide system, many of our State and local partners are facing really difficult budget situations. This puts even more emphasis on our issues programming and strategic planning activities throughout the System. The Extension System must do the best job it can in using its resources to meet its mission as the educational agency of the Department of Agriculture.

The Base Programs, supported mainly with the Smith-Lever formula and 1890's funds, provide for major educational efforts central to the mission of the System. Through these funds, the Federal Government has on "retainer" a nationwide cadre of highly trained and competent, scientific professionals. This is crucial for tackling specific issues and challenges focusing on agriculture, communities, and families.

Equally important, USDA and the research community depend upon the Extension System to help identify food, agriculture, consumer, and societal problems to assist in the design and conduct of research and to help convert research results into practical and usable forms.

Seven Base programs are the foundation of the System. The base programs are:

- Agricultural Competitiveness and Profitability
- Community Resource and Economic Development
- Family Development and Resource Management
- 4-H and Youth Development
- Leadership and Volunteer Development
- Natural Resources and Environmental Management
- Nutrition, Diet and Health

The Smith-Lever 3(b)&(c) funds are the primary federal funds that support these Base Programs, which are matched by the state and local funds.

Other sources of Federal funds include the Smith-Lever 3d funds and other earmarked funds authorized primarily from the various "Farm Bills". These funds are allocated to the States and other cooperators to address special programs or concerns of regional and national importance. A majority of these funds are distributed according to the extent of the problem that requires attention in each State, the remaining funds are awarded under a project proposal process that focuses on building quality issues-targeted programs that can be replicated throughout the Nation.

The following are brief summaries of the Smith-Lever 3(d) funds and other earmarked funded programs.

The Expanded Food and Nutrition Education Program (EFNEP) provides funds for educational programs to low-income families to increase nutrition knowledge and improve nutritional practices.

The Pest Management program consists of two major components: integrated pest management and cotton pest management. Programs address the efficient control of pest complexes on crops and livestock and in urban situations.

Pesticide Impact Assessment programs provide for the most objective and accurate data available for defining and evaluating benefits and risks of selected pesticides having critical agricultural and forestry uses.

The Urban Gardening program provides low-income urban residents in 23 cities with information on gardening skills, home use of produce, food preservation techniques, and marketing practices.

The Farm Safety program has two parts. The program provides for a base amount of $19,000 to each State to maintain farm safety expertise on staff. Additionally, in 1991, ES-USDA was funded to provide programs to disabled farmers and farm workers. Titled AgrAbility, these projects are done in cooperation with the National Easter Seal Society and other organizations serving disabled persons.

Extension Service supports regional Rural Development Centers in Pennsylvania, Mississippi, Oregon, Iowa, and North Dakota. The Center's programs are designed to improve the social and economic well-being of rural communities in their respective regions.

The Water Quality educational programs address the management of potential non-point source pollution on water quality from pesticides and plant nutrients used in agriculture. Funds are provided to States for Demonstration Projects, Hydrologic Unit Area projects and other initiatives within the USDA Water Quality Plan.

The Youth at Risk program, initially funded in FY 1991, is now conducted in over 90 sites nationwide. The program has generated significant support and resources from local governments, private foundations, and service organizations. The programs provide educational experiences for youth in the areas of science and technology, literacy, and other pressing needs of the nations next generation.

Funds for Food Safety projects have been awarded to the States for model programs to educate food handlers, reduce the risk of foodborne illness and to minimize hazards in maintaining a safe food supply.

The Indian Reservation Extension Agents program provides funds for educational efforts in the areas of economic and community development, and production and marketing practices for Native American groups.

The Renewable Resources Extension Act provides funding to all States for expanded natural resources education programs.

Formerly identified as Section 1440 Grants, the Disadvantaged Farmers Assistance Grants are designed to help financially stressed and dislocated farmers with financial planning, alternative income plans job placement, and overall family well-being.

Ag Telecommunications projects were initiated in FY 1992. The programs are satellite-delivered through AG*SAT and supported with materials and computer-based instructions addressing program categories, such as food science, waste management, and sustainable agriculture.

Extension Service-USDA completed a five year funding program for 1890's Facilities in FY 1992. The $47.5 million program has been highly successful in enhancing extension offices, classrooms, and buildings throughout the 17 Institutions. In FY 1993, Congress funded an $8 million facilities program for the 1890's to further upgrade research and extension facilities.

Three new grant program were initially funded in FY 1993. These addressed the issues of Rural Health and Safety; Outreach and Assistance for Socially Disadvantaged Farmers and Ranchers; and Rural Technology. These programs are expanding the audiences and clientele for the Extension System and are allowing for direct cooperative activities.

This concludes my remarks, Mr. Chairman. I will be happy to respond to any questions.

EXTENSION SERVICE

Purpose Statement

The Cooperative Extension System, a national educational network, is a dynamic organization pledged to meeting the country's needs for research, knowledge and educational programs that will enable people to make practical decisions. Its mission is to help people improve their lives through an educational process that uses scientific knowledge focused on issues and needs. Cooperative Extension work was established by the Smith-Lever Act of May 8, 1914, as amended. This work is further emphasized in Title XIV (National Agricultural Research, Extension, and Teaching Policy) of the Food and Agriculture Act of 1977, as amended.

To accomplish its mission, the Cooperative Extension System is constantly changing to meet the shifting needs and priorities of the people it serves. As peoples' needs and priorities change, program priorities, organizational structures, and external relationships must also change. To fulfill the requirements of the Smith-Lever Act, the Cooperative Extension Service in each state, the District of Columbia, Puerto Rico, the Virgin Islands, Guam, American Samoa, the Northern Marianas and Micronesia, conduct educational programs to improve American agriculture and strengthen the Nation's families and communities.

This public funded, nonformal educational network combines the expertise and resources of Federal, state and local governments. The partners in this unique System are:

- The Extension Service of the U.S. Department of Agriculture (USDA);
- Extension professionals at land-grant universities throughout the United States and its territories; and
- Extension professionals in nearly all of the Nation's 3,150 counties.

Thousands of paraprofessionals and nearly 3 million volunteers support this partnership and magnify its impact. Strong linkages with both public and private external groups are also crucial to the Extension System's strength and vitality.

The Extension Service, USDA, provides national leadership and represents the U.S. Department of Agriculture within the Cooperative Extension System, comprised of some 31,000 state and local Extension System employees and 2.9 million program service volunteers. As of September 30, 1992, there were 192 full-time permanent employees and 19 other than full-time permanent Extension Service-USDA employees, all located in the D.C. metropolitan area.

EXTENSION SERVICE

Available Funds and Staff-Years

1992 Actual and Estimated, 1993 and 1994

	1992 Actual		1993 Estimated		1994 Estimated	
Item	Amount	Staff-Years	Amount	Staff-Years	Amount	Staff-Years
Extension Service	$419,325,000	200	$424,928,000	180	$431,264,000	180
Obligations under Other USDA Appropriations:						
Agricultural Marketing Service - Pesticide Educational Materials	93,279		200,000		200,000	
Agricultural Stabilization and Conservation Service -						
Colorado River Salinity	630,000		650,000		650,000	
Rural Clean Water Project	296,967		250,000		250,000	
Agricultural Research Service -						
Food Safety	40,000		49,000		49,000	
Support Services	6,800		20,000		20,000	
Adopting Model Programs	40,000		–		–	
Alternative Agriculture Research and Commericialization - Administrative Support	22,600		30,000		30,000	
Cooperative State Research Service - PLANETOR--Microcomputers	100,000		100,000		100,000	
Internet Connection	40,000		50,000		50,000	
Sustainable Agric. Research and Education	50,000		70,000		70,000	
Support Services	32,500		–		–	
Federal Crop Insurance Corporation - Educational Activities	270,642		350,000		350,000	
National Agricultural Library - Networking Activities	5,000		–		–	
Office of International Cooperation and Development - Collaboration with the Neatherlands	7,500		–		–	
Rural Development Administration-President's Rural Devel. Initiative	1,224,600		–		–	
Soil Conservation Service -						
Farm Assessment System	45,000		60,000		60,000	
Water Quality Measures	45,000		65,000		65,000	
Technology Transfer Project	6,800		–		–	
Total, Other USDA Appropriations	2,956,688	–	1,894,000	–	1,894,000	–
Total, Agriculture Appropriations	422,281,688	200	426,822,000	180	433,158,000	180
Other Federal Funds:						
Reimbursements:						
AID-PASA International Extension	5,036,533		11,000,000		11,000,000	
Department of Commerce - Biobased Products Exposition	10,000		–		–	
Department of Interior -						
Fish & Wildlife Recognition Program	6,116		10,000		10,000	
Environmental Protection Agency -						
Air Pesticides and Toxics	28,160		40,000		40,000	

Item	1992 Actual Amount	1992 Actual Staff-Years	1993 Estimated Amount	1993 Estimated Staff-Years	1994 Estimated Amount	1994 Estimated Staff-Years
Water Quality	38,500		50,000		50,000	
Indoor Air Quality	27,088		–		–	
Pesticide Applicator Training	1,680,000		2,740,000		2,740,000	
Farmstead Assessment System	75,000		90,000		90,000	
Pesticide Safety Material	48,000		75,000		75,000	
Nat'l Institute of Standards and Technology -						
Technology Manufacture	50,000		–		–	
Endangered Species Educational Materials	13,000		–		–	
Pesticide Public Policy Foundation -						
National Road Site Training	40,000		55,000		55,000	
Department of Defense -						
Family Life Enrichment	1,413,876		1,816,000		1,816,000	
Total, Other Federal Funds	8,466,273		15,876,000		15,876,000	
Non-Federal Funds:						
Federal Assistance Program Retrieval	1,000		–		–	
Federal Building Funds	69,989		100,000		100,000	
Federal Telecommunication System	2,642		10,000		10,000	
Cost Share Printing	25,000		80,000		80,000	
Computerized Information Delivery System	–		40,000		40,000	
Total, Non-Federal Funds	98,631		230,000		230,000	–
Total, Extension Service	430,846,592	200	442,928,000	180	449,264,000	180

EXTENSION SERVICE

Permanent Positions by Grade and Staff Summary
1992 and Estimated 1993 and 1994

GRADE	1992	1993 Est.	1994 Est.
ES-6	1	1	1
ES-5	1	1	1
ES-4	4	4	4
ES-3	2	2	2
GS/GM-15	33	33	33
GS/GM-14	37	37	37
GS/GM-13	10	10	10
GS-12	11	11	11
GS-11	10	10	10
GS-10	1	1	1
GS-09	9	9	9
GS-08	7	7	7
GS-07	13	13	13
GS-06	24	24	24
GS-05	12	12	12
GS-04	15	15	15
GS-03	3	3	3
Other Graded Positions	0	0	0
Ungraded Positions	0	0	0
Total, Permanent positions	193	193	193
Unfilled positions End of Year	0	0	0
Total Permanent Employment End of Year	193	193	193
Staff Years: Ceiling	200	180	180

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EXTENSION SERVICE

CLASSIFICATION BY OBJECTS

1992 And Estimated 1993 and 1994

Personnel Compensation:	1992	1993	1994
Headquarters	$10,278,520	$10,658,000	$10,817,000
Field	-0-	-0-	-0-
11 Total Personnel Compensation	10,278,520	10,658,000	10,817,000
12 Personnel Benefits	1,788,942	1,855,000	1,883,000
Total Pers. Comp. & Benefits	12,067,462	12,513,000	12,700,000
Other Objects:			
21 Travel	791,841	820,000	832,000
22 Transportation of things	33,924	35,000	35,000
23.2 Communications, utilities & other rent	822,580	852,000	865,000
24 Printing & reproduction	422,613	437,000	444,000
25 Other services	1,881,520	1,948,000	1,977,000
26 Supplies & materials	400,484	413,000	419,000
31 Equipment	503,947	522,000	530,000
41 Grants, subsidies & contributions	403,880,077	408,097,000	413,462,000
Total other objects	408,736,986	413,124,000	418,564,000
Total direct obligations	420,804,448	425,637,000	431,264,000
Position Data:			
Average Salary, ES positions	$104,957	$108,657	$110,000
Salary, GM/GS positions	$ 48,440	$ 50,232	$ 51,000
Average Grade, GM/GS positions	9.99	9.99	9.99

EXTENSION SERVICE

The estimates include appropriation language for this item as follows (new language underscored; deleted matter enclosed in brackets):

Payments to States, Puerto Rico, Guam, the Virgin Islands, Micronesia,
Northern Marianas, and American Samoa: For payments for cooperative
agricultural extension work under the Smith-Lever Act, as amended, to be
distributed under sections 3(b) and 3(c) of said Act, for retirement and employees'
compensation costs for extension agents and for costs of penalty mail for
cooperative extension agents and State extension directors,[$262,712,000;]
$270,000,000; payments for the nutrition and family education program for low-
1 income areas under section 3(d) of the Act, [$60,525,000; payments for the urban
gardening program under section 3(d) of the Act, $3,557,000;] $62,201,000;
payments for the pest management program under section 3(d) of the Act,
[$8,200,000;] $8,565,000; payments for the farm safety and rural health programs
under section 3(d) of the Act, [$2,720,000;] $1,000,000; payments for the pesticide
impact assessment program under section 3(d) of the Act, $3,405,000; payments
to upgrade 1890 land-grant college [research and extension] facilities as
2 authorized by section 1447 of Public Law [99-198,] 95-113 as amended (7 U.S.C.
3222b), $8,000,000, to remain available until expended; payments for the rural
development centers under section 3(d) of the Act, $950,000; payments for
extension work under section 209(c) of Public Law 93-471, [$1,010,000;]
$1,038,000; payments for a groundwater quality program under section 3(d) of the
3 Act, $11,375,000; [special grants for financially stressed farmers and dislocated
farmers as authorized by Public Law 100-219, $2,550,000;] payments for the
Agricultural Telecommunications Program, as authorized by Public Law 101-624,
(7 U.S.C. 5926), $1,221,000; payments for youth-at-risk programs under section
3(d) of the Act, [$10,000,000;] $12,000,000; payments for a Nutrition Education
Initiative under section 3(d) of the Act, [$3,530,000;] $7,060,000; payments for a
food safety program under section 3(d) of the Act, [$1,500,000;] $2,000,000;
payments for carrying out the provisions of the Renewable Resources Extension
Act of 1978, [$2,765,000; payments for Indian reservation agents under section
3(d) of the Act, $1,750,000; payments to establish and operate centers of rural
technology developed as authorized by section 2347 of Public Law 101-624 (7
U.S.C. 1932), $1,000,000; payments for outreach and assistance for socially
4 disadvantaged farmers and ranchers as authorized by section 2501 of Public Law
101-624 (7 U.S.C. 2279), $1,000,000;] $2,841,000; payments for sustainable
agriculture programs under section 3(d) of the Act, $3,000,000; payments for a
new uses program under section 3(d) of the Act, $200,000; payments for rural
health and safety education as authorized by section 2390 of Public Law 101-624
(7 U.S.C. 2661 note, 2662), $2,000,000; and payments for extension work by the
colleges receiving the benefits of the second Morrill Act (7 U.S.C. 321-326, 328)
and Tuskegee University, [$24,730,000;] $27,764,000 in all, [$414,500,000,]
$424,620,000, of which not less than $79,400,000 is for Home Economics:
Provided, That funds hereby appropriated pursuant to section 3(c) of the Act of
June 26, 1953, and section 506 of the Act of June 23, 1972, as amended, shall
not be paid to any State, Puerto Rico, Guam, or the Virgin Islands, Micronesia,
Northern Marianas, and American Samoa prior to availability of an equal sum from
non-Federal sources for expenditure during the current fiscal year.

Federal administration and coordination: For administration of the Smith-Lever Act, as amended, and the Act of September 29, 1977 (7 U.S.C. 341-349), as amended, and section 1361(c) of the Act of October 3, 1980 (7 U.S.C. 301n.), and to coordinate and provide program leadership for the extension work of the Department and the several States and insular possessions, [$10,428,000,] $5,644,000, of which not less than $2,300,000 is for Home Economics.

The first change in language is for the purpose of deleting funding for Urban Gardening under Section 3(d) of the Act.

The second change provides for grants for 1890 land-grant college facilities under the provision of Section 1447 of P.L. 101-624.

The third change is for the purpose of deleting earmarked funding for Disadvantaged Farmer Assistance Programs, Indian Reservation Agents, Rural Technology Grants, and Socially Disadvantaged Farmers and Ranchers.

The fourth change adds to language providing funding for Sustainable Agriculture and New Uses Programs.

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EXTENSION SERVICE

Appropriations Act, 1993	$424,928,000
Budget Request, 1994	431,264,000
Increase in Appropriations	+6,336,000

SUMMARY OF INCREASES AND DECREASES
(On basis of appropriation)

Item of Change	1993 Estimated	Pay Costs	Other Changes	1994 Estimated
Base Programs:				
Smith-Lever 3b&c	$262,712,000	--	+$7,288,000	$270,000,000
1890 Colleges and Tuskegee University	24,730,000	--	+3,034,000	27,764,000
D.C. Extension	1,010,000	--	+28,000	1,038,000
Earmarked Programs and National Initiatives:				
EFNEP	60,525,000	--	+1,676,000	62,201,000
Pest Management	8,200,000	--	+365,000	8,565,000
Pesticide Impact Assessment	3,405,000	--	-0-	3,405,000
Urban Gardening	3,557,000	--	-3,557,000	-0-
Farm Safety	2,720,000	--	-1,720,000	1,000,000
Rural Development Centers	950,000	--	-0-	950,000
Water Quality	11,375,000	--	-0-	11,375,000
Youth at Risk	10,000,000	--	+2,000,000	12,000,000
Food Safety	1,500,000	--	+500,000	2,000,000
Indian Reservations	1,750,000	--	1,750,000	-0-
Nutrition Education Initiative	3,530,000	--	+3,530,000	7,060,000
Sustainable Agriculture	--	--	+3,000,000	3,000,000
New Uses	--	--	+200,000	200,000
Renewable Resources Extension Act	2,765,000	--	+76,000	2,841,000
Agricultural Telecommunications	1,221,000	--	-0-	1,221,000
Disadv. Farmers Ass't Grants	2,550,000	--	-2,550,000	-0-
Rural Technology Grants	1,000,000	--	-1,000,000	-0-
Soc. Disadv. Farmers/Ranchers	1,000,000	--	-1,000,000	-0-
Rural Health/Safety	2,000,000	--	-0-	2,000,000
Program Support:				
1890 Facilities (Sec. 1447)	8,000,000	--	-0-	8,000,000
Federal Administration and Coordination	10,428,000	+73,000	-3,857,000	5,644,000
Total, Available	424,928,000	+73,000	+5,236,000	430,264,000

PROJECT STATEMENT
(On basis of available funds)

Project	1992 Actual Amount	1992 Staff Years	1993 Estimated Amount	1993 Staff Years	Increase or Decrease	1994 Estimated Amount	1994 Staff Years
Payments to States:							
Smith-Lever Act							
1. Sections 3b&c:							
Program	$256 044 520	--	$256,044,520	--	+6,995,960	263,040,480	-0-
Set-aside for Federal Administration (4%)	6 667 480	--	6,667,480	--	+292,040	6,959,520	-0-
Subtotal, Sections 3b&c	262 712 000	--	262,712,000	--	[1]+7,288,000	270,000,000	-0-
2. Section 3d Program:							
EFNEP	60,525,000	--	60,525,000	--	+1,676,000	62,201,000	-0-
Pest Management	8,200,000	--	8,200,000	--	+365,000	8,565,000	-0-
Pesticide Impact Assessment	3,405,000	--	3,405,000	--	-0-	3,405,000	-0-
Urban Gardening	3,557,000	--	3,557,000	--	-3,557,000	-0-	-0-
Rural Health/Farm Safety	2,470,000	--	2,720,000	--	-1,720,000	1,000,000	-0-
Rural Development Centers	950,000	--	950,000	--	-0-	950,000	-0-
Water Quality	11,375,000	--	11,375,000	--	-0-	11,375,000	-0-
Youth and Families at Risk	10,000,000	--	10,000,000	--	+2,000,000	12,000,000	-0-
Food Safety	1,500,000	--	1,500,000	--	+500,000	2,000,000	-0-
Indian Reservations	1,500,000	--	1,750,000	--	-1,750,000	-0-	-0-
Nutrition Education Initiative	--	--	3,530,000	--	+3,530,000	7,060,000	-0-
Sustainable Agriculture	--	--	--	--	+3,000,000	3,000,000	-0-
New Uses	--	--	--	--	+200	200	-0-
Subtotal, Section 3d	103 482 000	--	107,512,000	--	[2]+4,244,000	111,756,000	-0-
Total, payments under the Smith-Lever Act	366 194 000	173	370,224,000	153	+11,532,000	381,756,000	153
Payments under Renewable Resources Extension Act	2 765 000	--	2,765,000	--	[3]+76,000	2,841,000	-0-
Payments to the District of Columbia:							
Program	969 600	1	969,600	1	+26,900	996,500	1
Set-aside for Federal Administration (4%)	40 400	--	40,400	--	+1,100	41,500	-0-
Total, payments to the District of Columbia	1,010,000	1	1,010,000	1	[4]+28,000	1,038,000	1
Payments to 1890 Colleges and Tuskegee University:							
Program	23,740,800	1	23,740,800	1	+2,912,640	26,653,440	1
Set-aside for Federal Administration (4%)	989,200	--	989,200	--	+121,360	1,110,560	-0-
Total, payments to 1890 Colleges and Tuskegee University	24,730,000	1	24,730,000	1	[5]+3,034,000	27,764,000	1

Project	1992 Actual Amount	1992 Actual Staff Years	1993 Estimated Amount	1993 Estimated Staff Years	Increase or Decrease	1994 Estimated Amount	1994 Estimated Staff Years
Ag. Telecommunications	1,221,000	–	1,221,000	–	-0-	1,221,000	-0-
Payments for Disadvantaged Farmers Assistance	2,550,000	–	2,550,000	–	[6]-2,550,000	-0-	-0-
1890's Facilities	10,987,532	–	708,938	–	-0-	-0-	-0-
Rural Technology	–	–	1,000,000	–	[7]-1,000,000	-0-	-0-
Soc. Disadv. Farmers/Ranchers	–	–	1,000,000	–	[8]-1,000,000	-0-	-0-
Rural Health/Safety	–	–	2,000,000	–	-0-	2,000,000	-0-
1890 Facilities (Sec. 1447)	–	–	8,000,000	–	-0-	8,000,000	-0-
Federal Administration and Coordination (Direct Appropriation	11,346,916	25	10,428,000	25	[9]-4,784,000	5,644,000	25
Program Set-Aside (non-add)	(3,055,910)	–	(3,345,590)	–	-0-	(4,986,750)	
Total Available	420,804,448	–	425,636,938	–	-0-	-0-	-0-
Unobligated Balance, Start of Year	-2,188,386	–	-708,938	–	-0-	-0-	-0-
Unobligated Balance, End of Year	708,938	–	-0-	–	-0-	-0-	-0-
Total Appropriation	419,325,000	200	424,928,000	180	+5,336,000	430,264,000	180
Investment Proposal	–	–	–	–	+1,000,000	1,000,000	–
Total, President's Budget	419,325,000	200	424,928,000	180	+6,336,000	431,264,000	180

EXPLANATION OF PROGRAM

The Cooperative Extension System, a national educational network, is a dynamic organization pledged to meeting the country's needs for research-based educational programs that will enable people to make practical decisions to improve their lives. To accomplish its mission, the Cooperative Extension System adjusts programs to meet the shifting needs and priorities of the people it serves.

This nonformal educational network combines the expertise and resources of federal, state, and local governments. The partners in this unique System are: (a) The Extension Service at the U.S. Department of Agriculture, (b) Extension professionals at land-grant universities throughout the United States and its territories; and (c) Extension professionals in nearly all of the Nation's 3,150 counties.

Thousands of paraprofessionals and nearly 3 million volunteers support this partnership and magnify its impact. Strong linkages with both public and private external groups are also crucial to the Extension System's strength and vitality.

Base Programs are the major educational efforts central to the mission of the System and common to most Extension units. They are the ongoing priority efforts of the System, involving many discipline-based and multi-disciplinary programs. The System's base programs are the foundation of the Extension organization.

National initiatives are the System's commitment to respond to important societal problems of broad national concern with additional resources and significantly increased effort to achieve a major impact on national priorities. They are the current most significant and complex issues on which the Extension System has the potential to make a difference--usually in cooperation with other agencies, groups and units of government.

Extension funds are provided to the States through formula grants and competitively awarded programs. Smith-Lever 3b and c funds and payments to the 1890 colleges and Tuskegee University provide funds to support the Extension infrastructure. Funds for designated programs provide support for the System to address identified priority issues.

Initiatives proposed in 1994 include funding for: sustainable agriculture education programs for farm operators in adopting environmentally benign methods that improve economic competitiveness education to encourage the production of new crops including rapeseed and kenaf; enhancement of youth at risk programs; expansion of food safety activities to all States, increased efforts on pest management, further support for historically black land-grant colleges; and increased funding in nutrition education to assist children, adults, and others at nutritional risk.

JUSTIFICATION OF INCREASE/DECREASE

(1) An increase of $7,288,000 for programs under section 3(b)&(c) of the Smith-Lever Act ($262,712,000 available in FY 1993).

Need for Change. The Cooperative Extension System, in cooperation with the Federal partner (ES-USDA) is dependent on base funds to carry out its legislated responsibilities. Federal funds appropriated to support base programs leverage significant state, local, and private sector support. Currently, within the Cooperative Extension System, each $4 in Federal Smith-Lever funds leverages in excess of $10 in state and other public or private sector funds.

The Cooperative Extension System reaches almost every county and most cities in the Nation. Through this partnership, USDA has on "retainer" an established network that is able to systematically provide objective information, education, and problem-solving assistance where needed and to obtain feedback on areas where further assistance is required. Programs supported by these funds enable Extension to serve, coordinate, cooperate, and establish coalitions and alliances with other relevant public agencies and private organizations in helping to resolve issues. These joint efforts enhance the Cooperative Extension System's capacity to fulfill its mission and Federal responsibilities helping people improve their lives through an educational process that uses scientific knowledge focused on issues and needs.

Base Programs are the major educational efforts central to the mission of the System and common to most Extension units. These are the ongoing priority efforts of the System, involving many discipline-based and multi-disciplinary programs. The educational Base Programs funded by Smith-Lever formula funds and State matching funds are a set of dynamic, changing, results-oriented programs that receive significant resources throughout the System on the national, state, and local levels. The System's base programs are the foundation of the Extension organization; these include:

- Agricultural Competitiveness and Profitability
- Community Resource and Economic Development
- Family Development and Resource Management
- 4-H and Youth Development
- Leadership and Volunteer Development
- Natural Resources and Environmental Management
- Nutrition, Diet and Health

Nature of Change. The proposed increase of $7,288,000 is requested to sustain the foundation for the educational Base Programs throughout the Cooperative Extension System at the level calculated for the Administration's Baseline Estimates.

Funds will be distributed according to the legislatively-established formula, which is based on the farm and rural population within each State, as well as an equal amount to each State.

(2) An net increase of $4,244,000 for programs under Section 3(d) of the Smith-Lever Act. ($107,512,000 available in FY 1993).

(a) An increase of $1,676,000 in payments to States for the Expanded Food and Nutrition Education Program (EFNEP) to support Infant and Maternal Nutrition Education under Section 3(d) of the Smith-Lever Act ($60,525,000 available in FY 1993).

Need for Change. EFNEP targets low-income youth and families with young children and helps them to acquire the knowledge, skills, attitudes and changed behavior necessary to improve their diets. Families are taught a nutrition curriculum which includes the relationship of nutrition to health, how to safely prepare nutritious meals, and the management of food resources such as food stamps. Successful model programs have been developed to meet the specific needs of infants and pregnant women. There is a need to continue these programs in order to provide this critical education to as many eligible recipients as possible. The funding level, adjusted for inflation in FY 1994, will allow for current participation levels to be maintained.

Over the course of the 20-year history of EFNEP, Cooperative Extension has demonstrated positive outcomes and has assisted low-income families in improving the total family diet and their nutritional welfare. These efforts need to continue. Additionally, it is critical to focus the program on the high priority areas that address the concerns of children.

Nature of Change. The requested funding level provides for EFNEP to maintain and conduct its programs at the level calculated for the Administration's Baseline Estimates.

(b) An increase of $365,000 for the Integrated Pest Management Program (IPM) under Section 3(d) of the Smith-Lever Act. ($8,200,000 available in FY 1993).

Need for Change. Extension programs have pioneered the Integrated Pest Management Program to attain sound economic returns to producers and 2other users. IPM has expanded its scope into horticultural and ornamental areas and developing the models to pattern the crop and animal management systems necessary for agriculture in the future. The Extension System has allocated over $87 million to IPM efforts since 1973. Additionally, the Federal funds leveraged a 4-to-1 ratio of State, county and private sector investments. Users reported higher prices for their crops than did non users. Yields for those using IPM practices were equal to or higher than for non-users.

Nature of Change. An increase in funding will allow Extension IPM programs to continue address horticultural crops and increase its support of projects that emphasize the use of bio-based technologies. These crops are most visible to the public since they are frequently eaten either fresh or lightly processed. In total, the requested funding level will provide for the IPM program at the level calculated for the Administration's Baseline Estimate.

(c) A decrease of $3,557,000 to eliminate Urban Gardening. ($3,557,000 available in FY 1993).

Need for Change. This program was developed with prior earmarked funds. Funding from the basic formula programs, State and local governments and private sources could be used to continue this program.

Nature of Change. This proposal will eliminate funds for Urban Gardening under Section 3(d) of the Smith-Lever Act.

(d) A decrease of $1,720,000 for the Farm Safety and Rural Health program under Section 3(d) of the Smith-Lever Act. ($2,720,000 available in FY93).

Need for Change. Emergency care and response is an important farm safety and rural health concern. Most rural and farm family members are not sure of procedures to follow if they arrive first on a farm accident scene. Many victims are discovered by family members or farm workers who must be able to act quickly and effectively to save the victim without injuring themselves. There are numerous farm accident situations which emergency medical or rescue personnel may confront with little prior experience or training. Many of these situations can readily become hazardous to the rescuer. Cases have occurred in which emergency personnel have been injured or killed while attempting to carry out a rescue or provide treatment to an injured person on a farm.

Nature of Change. The focus of the Farm Safety program will be shifted to providing funds ($800,000) for project proposals in targeted farm safety programs, with the objective of limiting exposure to occupational hazards. Potential areas of increased emphasis include programs that effectively reduce the traumatic injury and death rates of farmers and agriculture, such as health and safety education programs regarding exposure to agricultural chemicals, noise, dust, infectious agents, vibrations, etc.

Additionally, funds are requested ($200,000) for awarding project proposals to train emergency rescue professionals in farm accident extrication procedures and educate nonprofessionals in first-on-the-scene emergency response procedures. These programs are crucial to reducing the risk of injury to the rescuer, reducing the severity of the injury to the accident victim, and reinforcing the value of accident prevention.

(e) An increase of $2,000,000 for the Youth and Families at Risk program under Section 3(d) of the Smith-Lever Act. ($10,000,000 available in FY 1993).

Need for Change. The number of children in poverty increased by more than 3 million during the 1980's. By 1990 over 13 million children-nearly 2 in 5-were poor in America. Particularly affected are those aged prenatal to 5 years. Too young to determine their own destines, children must rely on the security built by their families and communities. All too often, however, their families fall victim to the overwhelming conditions of today's world.

The Extension System's response to Youth and Families at risk needs to continue providing a strong and positive response to these national

concerns. The Federal presence needs to reach more at risk families and more communities nationwide. The increasing rate of youth participation reflects the success of the program. The current Federal budget targets 96 communities. The positive response of this initiative is providing an opportunity to include other collaborators with the Extension System in fulfilling a commitment to youth and families at risk programming. This is reflective of the need for communities to help themselves through collaboration with the private sector. The National 4-H Council, contributes each year to support Youth At Risk programs and plays an integral role in resource and program development. The DeWitt Wallace-Reader's Digest Fund is providing a grant for staff development and training for Youth At Risk. Grants from other companies, foundations, and private citizens support Youth At Risk programming in numerous local communities across the Nation. Community CARES is a project created as part of a W. K. Kellogg Foundation package over a 3-year period. As a part of Community CARES, seven Centers For Action were created to provide nationwide technical assistance and training for Youth At Risk program sites . The programs and training at these Centers are needed in communities across the nation.

Nature of Change. The Cooperative Extension System is concerned about this critical societal problem. Utilizing a comprehensive program approach, and drawing on the expertise of community-based Extension professionals, Extension would expand its current outreach to children aged prenatal to 5 years and their families through programs that:

o Create community coalitions and build on successful paraprofessional models that support children.

o Provide access to comprehensive education.

o Improve families' skills in nutrition, money management, and parenting.

Additional funding for the Youth and Families At Risk Initiative would strengthen the funded sites, provide for expansion to more targeted communities and enhance the capacity of the organizational base with the goal of extending the outreach to meet the needs of the next generation of Americans.

(f) An increase of $500,000 for the Food Safety program under Section 3(d) of the Smith-Lever Act ($1,500,000 available in FY 1993).

Need for Change. The Cooperative Extension System is well suited to provide educational programs to address food safety and quality issues. It has staff who understand food systems from production to consumption, absolute and relative risks, risk communication techniques and the basis of identifying critical control points to target resources. This knowledge and experience is connected to an extensive delivery system which has established linkages with the critical target audiences and potential collaborators such as state and local governments and private sector organizations.

USDA has increased food safety research and data collection programs in recent years to improve the information available to producers and consumers. Enhanced Extension education programs are needed to transfer this information to a range of audiences. This program is coordinated with the food safety programs of other USDA agencies

Nature of Change. The requested increase will be used for education projects for which address the needs of the different participants within the food industry. The aim is to increase responsible involvement in protecting the safety of the food supply. Funds would be distributed to all States upon review and approval of a specific plan of work related to this issue. Model programs developed over the last 3 years would be replicated as relevant nationwide. Limited project proposals would also be requested to allow for newer, innovative projects.

(g) A decrease of $1,750,000 to eliminate the earmarked funding for Indian Reservation Extension Education ($1,750,000 available in FY 1993).

Need for Change. This program was developed with prior earmarked funds. Funding from basic formula programs, State and local governments and private sources could be used to continue high priority aspects of these programs.

Nature of Change. This proposal will eliminate specially earmarked funds for Indian Reservation Extension Education under Section 3(d) of the Smith-Lever Act.

(h) An increase of $3,530,000 for the Nutrition Education Initiative under Section 3(d) of the Smith-Lever Act. ($3,530,000 available in FY 1993).

Need for Change. With initial funding in FY 1993, the Cooperative Extension System nutrition educators are planning and will conduct innovative nutrition education programs with families enrolled in USDA's Federal Supplemental Food Programs for Women, Infants and Children (WIC). In order to address the objectives and goals of the Department's Nutrition Education plan and provide the outreach component of the Administration 1994 emphasis on increased WIC activity, funds are requested to provide for twice the number of currently planned projects and sites. This allows for the development, implementation, and replication of successful programs to address the needs of this ever growing clientele.

Pregnant women, nursing mothers, mothers with young children, and children from birth to 5 years of age have special nutritional needs. Those with limited incomes have an increased risk for developing nutrition and health-related problems. To meet the special needs of this population, USDA's Extension and the Food and Nutrition (FNS) are collaborating to develop nutrition education programs that target the most needy WIC clients, who are vulnerable to at-risk factors and to those who are eligible for food assistance programs and need help to receive these benefits.

Nature of Change. The requested increase allows for expansion and strengthening of the nutrition education programs coordinated between

Extension and the WIC program of the Food and Nutrition Service begun with the initial funding in FY93. Funds were distributed to States based upon the review and approval of a specific plan of work related to this project and 14 projects were funded in FY93 to begin developing more intensive program efforts to reach this targeted limited resource audience with nutrition education. These intensive efforts will be evaluated as models to be duplicated in other communities throughout the System.

The proposed FY94 level will allow for additional high quality State projects and increased funds to those States who develop approved plans. These added funds will bolster the coordination between Extension, and WIC's neediest and highest potential clientele and adopt some of the most effective models tested in the first year funding. In FY 1993, States were providing matching resources for this Initiative from non-Federal sources.

(i) An increase of $3,000,000 for Sustainable Agriculture under Section 3(d) of the Smith Lever Act.(no funds requested in FY 1993).

Need for Change. The U.S. agricultural sector faces major challenges in maintaining economic competitiveness while concurrently assuring responsiveness of agricultural production practices on the environment, economic opportunity and quality of life, food safety and quality, animal well-being and other concerns of society. The public and private sectors have supported research to improve economic competitiveness of the agricultural sector, while being proactive in dealing with environmental problems. These investments have resulted in, and will continue to provide, improved technology and production methods. The agricultural community needs new technologies and production methods efficiently integrated into existing production systems for U.S. agriculture to be economic competitive. The successful integration of these new technologies and production methods into existing systems requires careful analysis and site specific decision-making. New tools and approaches need to be developed and utilized to improve decision-making and access to research based information and education.

Nature of Change. The Sustainable Agriculture program is a critical step between research efforts and producers adopting improved management practices. The program effort will focus resources in the following areas:

o Establishing validation applied research and demonstration projects which provide an opportunity to illustrate how specific technologies, practices, and production subsystems can be successfully integrated into existing systems.

o Developing databases and decision support systems utilizing research based information and development efforts resulting from projects funded under subtitle B and other sources, such as GOSSYM-COMAX and PLANETOR decision support systems that are currently in the field and being improved on an annual basis. The decision support systems will be validated in concert with planned validation demonstration projects.

(j) An increase of $200,000 for New Uses for farm products and forest products. (No funds requested in FY 1993).

Need for Change. Increased international productivity and rapidly growing international competition require that alternatives to traditional U.S. agricultural outputs be identified and promoted. Meeting this requirement is integral to sustaining the economic and social viability of U. S. agriculture. In the FACT Act of 1990, Congress authorized the development of research and education programs that will promote sustainable agricultural production systems and practices. New agricultural crops and new uses for existing crops offer key opportunities for enhancing sustainability. Extension educational programs address these needs.

Certain of these programs are sufficiently developed for commercialization to justify expanded education for their production and marketing.

Nature of Change. Through development of written and electronic technical and economic guides, handbooks, and/or other educational materials, Extension will develop a program for Extension personnel and other agricultural professionals relating to the production of rapeseed and various commercial uses for kenaf.

(3) An increase of $76,000 for funding the Renewable Resources Extension Act (RREA) (P.L. 95-306) ($2,765,000 available in FY 1993).

Need for Change. The Cooperative Extension System (CES) provides research-based education about renewable natural resources and the environment. Each state conducts its own renewable natural resources education program, with approval by USDA. Education helps landowners and managers sustain productivity and protect the environment on the 800 million acres of privately owned forests and rangelands. This is one-third of the total land area of the United States. Education enables renewable natural resources to better serve individual owners, local communities, and the Nation as a whole.

Nature of Change. The increased funding will provide for the RREA program to maintain current program levels by adjusting for inflation as calculated for the Administration's Baseline Estimates.

(4) A increase of $28,000 in funds authorized under Public Law 93-471 for D.C. Extension. ($1,010,000 available funding in FY 1993).

Need for Change. The D.C. Public Post Secondary Education Act of 1972 establishes the D.C. Extension Service and authorized extension program for the people of the District of Columbia. The D.C. Cooperative Extension Service conducts programs addressing critical issues and problems, especially in the areas of youth development, family living, home horticulture, consumer education, community resource development, and food and nutrition.

Nature of Change. The requested funding level will provide for the D.C. Extension program at the level calculated for the Administration's Baseline Estimates.

(5) An increase of $3,034,000 for the 1890 Colleges and Tuskegee University ($24,730,000 available in FY 1993).

Need for Change. For over two decades, Extension Service has been working with the 1890 Institutions in fostering, developing, implementing and improving extension educational programs to benefit their clientele. The recently completed 1890's Facilities Program provided almost $48 million for the construction, renovation and upgrade of the facility and equipment needed to operate Extension programs.

The 1890 Institutions, within the partnership of the Cooperative Extension System are almost totally dependent on Federal funds to conduct their legislated responsibilities. Federal funds provide support for the educational base programs, as well as, implementing programs focusing on specific national initiatives. There is a need for increased funding for the Extension programs at the 1890 Land-Grant Institutions and Tuskegee University to address needs of small-scale and minority farmers and other limited resource audiences.

Nature of Change. Of the proposed increase of $684,000 is requested to maintain the foundation of the educational Base Programs at the level calculated for the Administration's Baseline Estimates.

The remaining $2,350,000 will be for increased emphasis on responding to the national issues of adolescent pregnancy and sustainability of small-scale farm operations.

o Adolescent pregnancy and Health programs ($1.5 million). Funds would be used to identify and develop effective educational programs to significantly reduce this problem affecting the total country. Focused on the plight of young children (prenatal to 5) in the areas of nutrition and health. Paraprofessionals, focusing on individuals, through a series of lessons will teach pregnant teens and teen parents nutrition for themselves and their infant and encourage appropriate prenatal and well-being health care.

o Sustainable agriculture for small-scale and limited resource farmers ($850,000). The funds would be employed to establish projects with educational components targeted to limited resources, socially disadvantaged farmers. Through demonstrations, individual counseling and small group meetings, the targeted clientele would acquire skills and knowledge in budgeting, financial management, planning, resource allocation, and marketing toward the goal of achieving viable economic operations.

Funds will be distributed according to the legislatively-established formula, which is based on the farm and rural population within each State, as well as an equal amount to each State.

(6) A decrease of $2,550,000 to eliminate payments to States for Disadvantaged Farmer Assistance ($2,550,000 available in FY 1993).

Need for Change. Disadvantaged Farmer Assistance grants were provided to the States of Nebraska, Iowa, Missouri, Kansas, Mississippi, North Dakota, Oklahoma and Vermont to provide educational and counseling programs for economically distressed or displaced farmers. Initiated during the farm crisis of the early 1980's, these problems are now being addressed by major national initiatives in agricultural profitability and rural revitalization through ongoing Extension programs. Funding from basic formula programs, State and local governments and private sources could be used to continue high priority aspects of these programs within the designated States.

Nature of Change. This proposal will eliminate specifically earmarked funding for this program.

(7) A decrease of $1,000,000 to eliminate Rural Technology Grants ($1,000,000 available in FY 1993).

Need for Change. This project is proposed for elimination as presented in the Administration's "A Vision of Change for America." This earmarked special grant could be considered for financing within the priorities of the respective States.

Nature of Change. This proposal will eliminate earmarked Federal funding support for these projects.

(8) A decrease of $1,000,000 to eliminate Outreach and Assistance to Socially Disadvantaged Farmers and Ranchers. ($1,000,000 funding available in FY 1993).

Need for Change. It was determined by the Secretary that this program will be administered by the Farmers Home Administration (FmHA) within USDA, rather than the Extension Service. FmHA has a request in the FY 1994 President's Budget to continue this program.

Nature of Change. This proposal will eliminate funding within the Extension Service appropriation for this program, based on the transfer of responsibility to FmHA.

(9) A net decrease of $4,784,000 for Federal Administration and Coordination (direct line) ($10,428,000 available in FY 1993).

Project	1993	Inc/Dec	1994
Technology Transfer.(OK/MS)....	$ 331,000	-$331,000	--
Farm Financial Mgmt. (NE)........	200,000	-200,000	--
Rural Development.(OK)............	300,000	-300,000	--
Chinch Bug/Russian Wheat Aphid..(NE)................................	67,000	-67,000	--
American Pacific Init. (HI)..........	647,000	-647,000	--
Tourism.(NM)............................	230,000	-230,000	--
Project Future.(MN)..................	250,000	-250,000	--
Rural Education Model.(ND)	846,000	-846,000	--
Pilot Technology.(WI)................	165,000	-165,000	--
Crop Simulation Projects.(MS)...	498,000	-498,000	--
Rural Rehabilitation Projects..(GA)........................	250,000	-250,000	--
Presque Island.(ME)..................	187,000	-187,000	--
Income Enhancement.(OH).......	250,000	-250,000	--
Rural Health.(AL)......................	200,000	-200,000	--
Beef Producers.(AR)..................	200,000	-200,000	--
Integrated Cow/Calf Mgmt. (IA)..	150,000	-150,000	--
Home Sewing.(AL,SC,MS,OR)..	157,000	-157,000	--
Extension Specialist.(AR)...........	100,000	-100,000	--
Subtotal......................................	5,028,000	-5,028,000	--
Base, Federal Administration......	5,400,000	--	5,400,000
Non-Salary Cost Increase...........	--	+117	117
Annualization, FY93 Pay raise	--	+73	73
Reduction in Administrative Expenses............................	--	-139	-139
Reduction in FTS 2000 Funding	--	-7	-7
1890 Center of Excellence........	--	+200,000	200,000
TOTAL......................................	$10,428,000	-$4,784,000	$5,644,000

(a) A decrease of $5,028,000 for special projects ($5,028,000 available in FY 1993).

Need for Change. These projects are proposed for elimination as presented in the Administration's "A Vision of Change for America." Each of these earmarked special grants that could be considered for financing within the priorities of the respective States.

Nature of Change. This proposal will eliminate earmarked Federal funding support for these projects.

(b) An increase of $117,000 which reflects a 2.7 percent increase in non-salary costs.

(c) An increase of $73,000 which reflects the annualization of the fiscal year 1993 pay raises.

(d) A decrease of $139,000 for administrative efficiency.

Need for Change. To promote the efficient use of resources for administrative purposes, in keeping with the President's Executive Order, total USDA baseline outlays for these activities will be reduced by 3 percent in FY 1994, 6 percent in FY 1995, 9 percent in FY 1996, and 14 percent in FY 1997.

Nature of Change. Extension Service will reduce operating costs related to program coordination with state partners to achieve the proposed reduction.

(e) A decrease of $7,000 for FTS 2000 funding. This decrease reflects lower long distance telecommunications prices due to price redetermination in the FTS 2000 contracts .

(f) An increase of $200,000 to establish a Center of Excellence for Horticulture at Tennessee State University.

Need for Change. There is a need for increased support to the 1890's to meet the multiple challenges of increasing access, delivery options and best utilization of programs and facilities. The Centers of Excellence concept built on the existing strengths of the Institutions and compatibility of the program priorities with USDA initiatives is the next logical step to build upon the good work USDA and Extension Service have done with the 1890 Institutions.

Nature of Change. The proposed funding level of $200,000 will establish an outreach program for a National Center of Excellence in Horticulture. This proposal is in agreement with the 1890's Presidents/Chancellors priorities. This Horticulture Center of Excellence will be in cooperation with the established Agricultural Research Service center at the University. It would meet the needs of farmers and producers in the Ornamental Horticulture/Nursery Crop area and related Agricultural Biotechnology and Plants.

EXTENSION SERVICE

SUMMARY OF INCREASES AND DECREASES-INVESTMENT PROPOSAL

Item of Change	Base Request	Investment Proposal	Total Request
Base Program:			
Smith-Lever 3b&c	$270,000,000	--	270,000,000
1890 Colleges and Tuskegee Univ.	27,764,000	--	27,764,000
D.C. Extension	1,038,000	--	1,038,000
Earmarked Programs and National Initiatives:			
EFNEP	62,201,000	--	62,201,000
Pest Management	8,565,000	--	8,565,000
Pesticide Impact Assessment	3,405,000	--	3,405,000
Urban Gardening	-0-	--	-0-
Farm Safety	1,000,000	--	1,000,000
Rural Development Centers	950,000	--	950,000
Water Quality	11,375,000	--	11,375,000
Youth at Risk	12,000,000	--	12,000,000
Food Safety	2,000,000	--	2,000,000
Indian Reservations	-0-	--	-0-
Nutrition Education Initiative	7,060,000	--	7,060,000
Sustainable Agriculture	3,000,000	--	3,000,000
New Uses	200,000	--	200,000
Renewable Resources Extension Act	2,841,000	+1,000,000	3,841,000
Agricultural Telecommunications	1,221,000	--	1,221,000
Disadv. Farmers Ass't Grants	-0-	--	-0-
Rural Technology Grants	-0-	--	-0-
Soc. Disadv. Farmers/Ranchers	-0-	--	-0-
Rural Health/Safety	2,000,000	--	2,000,000
Program Support			
1890 Facilities (Sec. 1447)	8,000,000	--	8,000,000
Federal Administration and Coordination	5,644,000	-0-	5,644,000
Total, Available	430,264,000	+1,000,000	431,264,000

Explanation of Investment Proposal

Managing the Nation's forest resources relies increasingly upon scientific information and technology. This includes areas as diverse as understanding forest ecosystems and the wildlife/urban interface to extending the use of wood as a raw material. This investment will allow the Extension Service to transfer the results of agricultural research programs to provide the necessary information to help the Nation develop sound forest-related policies that will both provide resources to meet ever-increasing demands from the population and sustain forest ecosystem.

Major strides have been made in providing the scientific underpinning for human health. As a result, people all over the world have the potential to live longer, healthier lives. It is now time to pay the same attention to the health of our Nation's and the world's forest resources. Concern about, and interest in, forest and their role has never been greater. But, the existing state of knowledge is simply inadequate to develop sound forest-related policies that will both provide resources to meet ever increasing demands for a growing population and sustain ecosystems.

A National Research Council report found that: (1) the demand for scientifically-based information on the status of forests and environmental issues will continue to increase; (2) a strengthened extension program as an important technology transfer and education mechanism for forest land owners, natural resource professionals, policymakers, and the public.

The application of science to ecosystem management calls for a systematic extension process to (1) provide continuing education for natural resource professionals; (2) enable landowners/managers to adapt and utilize research results; (3) assure basic understanding by public decisionmakers; and (4) reach the general public with education to guide their individual and collective actions.

$1 million of the proposed increased would provide for the education and technology transfer that is essential to the application of existing future ecosystem management knowledge. Extension would develop and implement programs to:

- Provide for ecosystem management education in partnerships with the USDA Forest Service, Extension Service, Cooperative State Research Service, the natural resource and forestry academic community, and forest industry;

- Forest productivity, biological diversity, and an sustainable basis for rural economic development;

- Provide for systematic extension of research products through education and demonstration for: natural resource professionals; landowners/managers; public decision makers; and the general public;

- Develop high-level competence by natural resource professionals; managers, and landowners on adapting and applying principles and techniques of ecosystem management;

- Increase public awareness as the relationship between people and ecosystem.

Investment Language

In addition to funding already available under this heading, and subject to the same terms and conditions, $1,000,000 for natural resources education programs under the Renewable Resources Extension Act of 1978.

EXTENSION SERVICE
GEOGRAPHIC BREAKDOWN OF OBLIGATIONS
1992 AND ESTIMATED 1993 AND 1994
(Amounts in 000's)

State/Territory	FY 1992 Actual Obligations	Estimated Obligations FY 1993	FY 1994
Alabama	$ 13,022	$ 12,277	$ 12,729
Alaska	1,626	1,337	1,357
Arizona	3,346	2,786	2,729
Arkansas	9,544	8,719	8,973
California	11,865	10,696	10,803
Colorado	4,059	3,646	3,631
Connecticut	3,295	2,592	2,574
Delaware	2,407	2,278	2,350
Florida	9,122	8,357	8,559
Georgia	12,598	12,378	12,643
Hawaii	2,451	1,725	1,648
Idaho	3,708	3,048	3,114
Illinois	12,303	11,609	11,611
Indiana	10,112	9,470	9,618
Iowa	11,973	9,927	10,182
Kansas	7,422	6,208	6,340
Kentucky	13,252	12,814	13,233
Louisiana	10,003	8,924	9,033
Maine	3,054	2,621	2,676
Maryland	6,211	5,567	5,611
Massachusetts	4,029	3,702	3,642
Michigan	10,965	10,300	10,418
Minnesota	11,295	9,459	9,694
Mississippi	12,222	10,605	10,877
Missouri	12,956	12,238	12,577
Montana	3,311	2,850	2,914
Nebraska	7,007	5,510	5,635
Nevada	1,716	1,425	1,447
New Hampshire	2,147	1,871	1,912
New Jersey	4,411	3,980	3,926
New Mexico	3,247	2,678	2,727
New York	13,256	11,512	11,732
North Carolina	17,486	16,792	17,335
North Dakota	5,557	3,875	3,944
Ohio	12,794	11,917	12,102
Oklahoma	9,039	7,979	8,255
Oregon	5,171	4,358	4,468
Pennsylvania	13,176	12,337	12,510
Rhode Island	1,589	1,399	1,419
South Carolina	9,658	8,777	9,053
South Dakota	4,161	3,759	3,843
Tennessee	13,490	12,797	13,064
Texas	20,882	19,978	20,554
Utah	2,489	2,109	2,144
Vermont	2,543	1,983	2,020
Virginia	11,828	10,720	11,078
Washington	5,584	4,878	4,905
West Virginia	5,127	4,908	4,999
Wisconsin	10,382	9,297	9,396
Wyoming	2,062	1,769	1,799
American Samoa	543	905	935
Guam	955	953	985
Micronesia	737	982	1,020
No. Mariana Islands	448	885	915
Puerto Rico	8,013	7,851	8,017
Virgin Islands	906	932	964
District of Columbia	970	970	996
Sub-total	$403,525	$366,619	$373,635
To be allocated: (91/92)			
Earmarked Efforts	1,524	40,672	39,267
FERS	--	4,000	4,000
Federal Administration	14,276	13,637	14,362
Unobligated Balance	1,479	709	-0-
Total Available	$420,804	$425,637	$431,264

APPROPRIATION FOR PAYMENTS TO STATES
STATE ALLOTMENTS, FY 1992 – 1994

Smith-Lever Act: Section 3 (b) & 3 (c)	FY 1992	FY 1993	FY 1994
Alabama	5,636,834	5,636,834	5,775,423
Alaska	845,660	845,660	879,425
American Samoa	717,072	717,072	743,309
Arizona	1,476,703	1,476,703	1,527,049
Arkansas	4,762,714	4,762,714	4,881,720
California	5,895,722	5,895,722	6,125,586
Colorado	2,312,488	2,312,488	2,395,447
Connecticut	1,738,548	1,738,548	1,797,778
Delaware	998,270	998,270	1,035,883
Florida	3,450,980	3,450,980	3,597,505
Georgia	6,355,612	6,355,612	6,543,708
Guam	756,380	756,380	784,329
Hawaii	1,048,762	1,048,762	1,083,657
Idaho	2,097,753	2,097,753	2,173,840
Illinois	7,720,646	7,720,646	7,971,671
Indiana	6,969,925	6,969,925	7,215,851
Iowa	7,409,129	7,409,129	7,666,009
Kansas	4,309,696	4,309,696	4,445,909
Kentucky	7,298,296	7,298,298	7,526,660
Louisiana	4,224,710	4,224,710	4,338,308
Maine	1,744,080	1,744,080	1,807,180
Maryland	2,632,927	2,632,927	2,720,815
Massachusetts	2,171,721	2,171,721	2,245,490
Michigan	7,023,309	7,023,309	7,256,212
Micronesia	780,202	780,202	811,198
Minnesota	6,916,025	6,916,025	7,148,199
Mississippi	5,817,172	5,817,172	5,942,926
Missouri	6,839,245	6,839,245	7,064,087
Montana	1,959,508	1,959,508	2,034,028
Nebraska	3,913,028	3,913,028	4,045,830
Nevada	855,334	855,334	890,018
New Hamphshire	1,256,100	1,256,100	1,309,251
New Jersey	2,136,250	2,136,250	2,210,063
New Mexico	1,580,263	1,580,263	1,634,245
New York	6,591,726	6,591,726	6,801,190
North Carolina	9,551,043	9,551,043	9,805,846
North Dakota	2,700,219	2,700,219	2,781,553
Ohio	8,484,494	8,484,494	8,776,451
Oklahoma	4,329,311	4,329,311	4,456,724
Oregon	2,765,481	2,765,481	2,876,865
Pennsylvania	8,260,107	8,260,107	8,533,035
Puerto Rico	5,863,606	5,863,606	5,963,831
Rhode Island	845,300	845,300	877,323
South Carolina	4,637,762	4,637,762	4,767,780
South Dakota	2,797,866	2,797,866	2,892,748
Tennessee	6,972,168	6,972,168	7,161,785
Texas	9,738,128	9,738,128	10,049,639
Utah	1,291,529	1,291,529	1,334,820
Vermont	1,385,231	1,385,231	1,435,628
Virgin Islands	737,207	737,207	764,894
Virginia	5,788,162	5,788,162	5,954,941
Washington	3,264,718	3,264,718	3,383,833
West Virginia	3,362,734	3,362,734	3,455,634
Wisconsin	6,910,173	6,910,173	7,149,562
Wyoming	1,170,394	1,170,394	1,213,823
Northern Mariana Islands	696,166	696,166	722,257
Sub-Total	219,794,611	219,794,611	226,791,091
3(b) Special Needs	1,544,909	1,544,909	1,544,909
3(c) Fed'l Admin	6,667,480	6,667,480	6,959,000
Total	228,007,000	228,007,000	235,295,000
Retirement	15,252,000	15,252,000	15,252,000
Penalty Mail	15,453,000	15,453,000	15,453,000
FERS	4,000,000	4,000,000	4,000,000
	262,712,000	262,712,000	270,000,000

APPROPRIATION FOR PAYMENTS TO STATES
FOOD AND NUTRITION EDUCATION, FY 1992 - 1994

Smith-Lever Act: Section 3 (d)	FY 1992	FY 1993	FY 1994
Alabama	1,959,269	1,959,269	1,997,069
Alaska	172,555	172,555	177,460
American Samoa	63,041	63,041	66,732
Arizona	559,425	559,425	579,896
Arkansas	1,248,919	1,248,919	1,272,966
California	3,306,089	3,306,089	3,443,205
Colorado	554,712	554,712	572,005
Connecticut	452,897	452,897	467,828
Delaware	220,669	220,669	226,899
Florida	2,028,220	2,028,220	2,095,782
Georgia	2,133,095	2,133,095	2,179,307
Guam	63,260	63,260	67,054
Hawaii	256,769	256,769	264,484
Idaho	291,144	291,144	300,152
Illinois	2,121,138	2,121,138	2,182,356
Indiana	1,193,997	1,193,997	1,223,220
Iowa	895,041	895,041	912,416
Kansas	689,151	689,151	704,010
Kentucky	1,646,822	1,646,822	1,680,033
Louisiana	1,858,178	1,858,178	1,896,966
Maine	418,454	418,454	428,960
Maryland	838,473	838,473	861,106
Massachusetts	967,105	967,105	997,790
Michigan	1,769,438	1,769,438	1,816,950
Micronesia	69,682	69,682	76,453
Minnesota	985,888	985,888	1,007,841
Mississippi	1,694,371	1,694,371	1,725,226
Missouri	1,540,243	1,540,243	1,572,701
Montana	295,429	295,429	303,183
Nebraska	534,622	534,622	545,861
Nevada	170,861	170,861	177,312
New Hamphshire	237,247	237,247	244,160
New Jersey	1,068,054	1,068,054	1,104,799
New Mexico	506,066	506,066	520,128
New York	3,394,059	3,394,059	3,509,247
North Carolina	2,495,823	2,495,823	2,541,375
North Dakota	341,536	341,536	348,488
Ohio	2,178,542	2,178,542	2,235,053
Oklahoma	1,043,512	1,043,512	1,066,522
Oregon	491,618	491,618	508,446
Pennsylvania	2,674,542	2,674,542	2,738,610
Puerto Rico	1,434,538	1,434,538	1,519,321
Rhode Island	301,382	301,382	309,087
South Carolina	1,508,390	1,508,390	1,536,041
South Dakota	385,718	385,718	394,168
Tennessee	1,958,079	1,958,079	1,997,116
Texas	4,167,402	4,167,402	4,269,874
Utah	307,368	307,368	317,972
Vermont	233,258	233,258	239,279
Virgin Islands	62,065	62,065	66,459
Virginia	1,672,785	1,672,785	1,706,442
Washington	676,743	676,743	699,605
West Virginia	966,995	966,995	984,215
Wisconsin	951,069	951,069	975,075
Wyoming	187,635	187,635	192,418
Northern Mariana Islands	61,297	61,297	64,497
Sub-Total	60,304,680	60 304,680	61,913,640
Fed'l Admin	220,320	220,320	287,360
Total	60,525,000	60.525,000	62,201,000

APPROPRIATION FOR PAYMENTS TO STATES
INTEGRATED PEST MANAGEMENT, FY 1992 – 1994

Smith–Lever Act: Section 3 (d)	FY 1992	FY 1993	FY 1994
Alabama	243,941	243,941	243,941
Alaska	42,900	42,900	42,900
American Samoa	11,000	11,000	11,000
Arizona	87,000	87,000	87,000
Arkansas	263,243	263,243	263,243
California	253,100	253,100	253,100
Colorado	87,000	87,000	87,000
Connecticut	55,000	55,000	55,000
Delaware	55,000	55,000	55,000
Florida	155,200	155,200	155,200
Georgia	332,810	332,810	332,810
Guam	11,000	11,000	11,000
Hawaii	55,000	55,000	55,000
Idaho	87,000	87,000	87,000
Illinois	253,100	253,100	253,100
Indiana	190,400	190,400	190,400
Iowa	253,100	253,100	253,100
Kansas	155,200	155,200	155,200
Kentucky	87,000	87,000	87,000
Louisiana	271,600	271,600	271,600
Maine	87,000	87,000	87,000
Maryland	87,000	87,000	87,000
Massachusetts	87,000	87,000	87,000
Michigan	155,200	155,200	155,200
Micronesia	11,000	11,000	11,000
Minnesota	221,200	221,200	221,200
Mississippi	325,902	325,902	325,902
Missouri	229,489	229,489	229,489
Montana	87,000	87,000	87,000
Nebraska	221,200	221,200	221,200
Nevada	42,900	42,900	42,900
New Hamphshire	55,000	55,000	55,000
New Jersey	87,000	87,000	87,000
New Mexico	55,000	55,000	55,000
New York	121,100	121,100	121,100
North Carolina	237,541	237,541	237,541
North Dakota	87,000	87,000	87,000
Ohio	221,200	221,200	221,200
Oklahoma	230,900	230,900	230,900
Oregon	121,100	121,100	121,100
Pennsylvania	121,100	121,100	121,100
Puerto Rico	36,300	36,300	36,300
Rhode Island	42,900	42,900	42,900
South Carolina	209,965	209,965	209,965
South Dakota	87,000	87,000	87,000
Tennessee	191,079	191,079	191,079
Texas	632,730	632,730	632,730
Utah	55,000	55,000	55,000
Vermont	42,900	42,900	42,900
Virgin Islands	11,000	11,000	11,000
Virginia	121,100	121,100	121,100
Washington	121,100	121,100	121,100
West Virginia	42,900	42,900	42,900
Wisconsin	155,200	155,200	155,200
Wyoming	55,000	55,000	55,000
Northern Mariana Islands	11,000	11,000	11,000
Sub–Total	7,656,400	7,656,400	7,656,400
Special Projects	543,600	543,600	908,600
Total	8,200,000	8,200,000	8,565,000

APPROPRIATION FOR PAYMENTS TO STATES
PESTICIDE IMPACT ASSESSMENT, FY 1992 – 1994

Smith–Lever Act: Section 3 (d)	FY 1992	FY 1993	FY 1994
Alabama	29,040	25,677	25,677
Alaska	10,205	10,204	10,204
American Samoa	10,000	10,000	10,000
Arizona	29,836	26,207	26,207
Arkansas	36,167	32,679	32,679
California	121,688	107,020	107,020
Colorado	25,165	28,218	28,218
Connecticut	11,735	11,725	11,725
Delaware	28,420	21,563	21,563
Florida	46,305	48,853	48,853
Georgia	35,384	47,566	47,566
Guam	10,000	10,383	10,383
Hawaii	15,620	12,357	12,357
Idaho	46,466	36,075	36,075
Illinois	49,723	55,550	55,550
Indiana	34,797	37,760	37,760
Iowa	67,844	70,239	70,239
Kansas	44,177	47,012	47,012
Kentucky	45,380	41,687	41,687
Louisiana	24,990	31,060	31,060
Maine	19,073	12,555	12,555
Maryland	19,602	16,312	16,312
Massachusetts	12,246	15,365	15,365
Michigan	31,476	34,362	34,362
Micronesia	10,000	10,000	10,000
Minnesota	47,603	53,527	53,527
Mississippi	27,741	27,523	27,523
Missouri	45,040	44,676	44,676
Montana	21,420	21,248	21,248
Nebraska	58,264	66,919	66,919
Nevada	11,075	11,069	11,069
New Hamphshire	20,746	20,391	20,391
New Jersey	29,392	22,524	22,524
New Mexico	16,003	15,967	15,967
New York	31,136	27,673	27,673
North Carolina	47,569	40,669	40,669
North Dakota	22,720	25,773	25,773
Ohio	42,254	41,833	41,833
Oklahoma	38,617	41,560	41,560
Oregon	29,095	28,777	28,777
Pennsylvania	32,757	29,374	29,374
Puerto Rico	13,250	18,056	18,056
Rhode Island	10,354	10,352	10,352
South Carolina	21,195	21,020	21,020
South Dakota	30,918	36,866	36,866
Tennessee	36,821	36,307	36,307
Texas	86,907	88,966	88,966
Utah	14,383	14,352	14,352
Vermont	12,441	12,425	12,425
Virgin Islands	10,000	10,007	10,007
Virginia	27,649	24,290	24,290
Washington	29,160	28,947	28,947
West Virginia	14,562	14,521	14,521
Wisconsin	61,963	67,221	67,221
Wyoming	13,626	16,737	16,737
Northern Mariana Islands	10,000	10,001	10,001
Sub–Total	1,730,000	1,730,000	1,730,000
Special Projects	1,675,000	1,675,000	1,675,000
Total	3,405,000	3,405,000	3,405,000

APPROPRIATION FOR PAYMENTS TO STATES
URBAN HOME GARDENING, FY 1992 – 1994

Smith–Lever Act: Section 3 (d)	FY 1992	FY 1993	FY 1994
Alabama			
Alaska			
American Samoa			
Arizona	108,500	108,500	0
Arkansas			
California	241,500	241,500	0
Colorado	96,000	96,000	0
Connecticut	72,500	72,500	0
Delaware			
Florida	145,000	145,000	0
Georgia	145,000	145,000	0
Guam			
Hawaii	101,000	101,000	0
Idaho			
Illinois	291,000	291,000	0
Indiana	108,500	108,500	0
Iowa			
Kansas			
Kentucky	72,000	72,000	0
Louisiana	145,000	145,000	0
Maine			
Maryland	145,000	145,000	0
Massachusetts	145,000	145,000	0
Michigan	145,000	145,000	0
Micronesia			
Minnesota			
Mississippi			
Missouri	145,000	145,000	0
Montana			
Nebraska			
Nevada			
New Hamphshire			
New Jersey	145,000	145,000	0
New Mexico			
New York	485,000	485,000	0
North Carolina			
North Dakota			
Ohio	145,000	145,000	0
Oklahoma			
Oregon			
Pennsylvania	145,000	145,000	0
Puerto Rico			
Rhode Island			
South Carolina			
South Dakota			
Tennessee	145,000	145,000	0
Texas	145,000	145,000	0
Utah			
Vermont			
Virgin Islands			
Virginia			
Washington	96,000	96,000	0
West Virginia			
Wisconsin	145,000	145,000	0
Wyoming			
Northern Mariana Islands			
Total	3,557,000	3,557,000	0

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APPROPRIATION FOR PAYMENTS TO STATES
FARM SAFETY, FY 1992 – 1994

Smith–Lever Act: Section 3 (d)	FY 1992	FY 1993	FY 1994
Alabama	19,019	19,019	0
Alaska	19,020	19,020	0
American Samoa	0	0	0
Arizona	19,020	19,020	0
Arkansas	19,020	19,020	0
California	19,019	19,019	0
Colorado	19,020	19,020	0
Connecticut	19,020	19,020	0
Delaware	19,020	19,020	0
Florida	19,020	19,020	0
Georgia	19,019	19,019	0
Guam	19,019	19,019	0
Hawaii	0	0	0
Idaho	19,020	19,020	0
Illinois	19,020	19,020	0
Indiana	19,020	19,020	0
Iowa	19,019	19,019	0
Kansas	19,019	19,019	0
Kentucky	19,019	19,019	0
Louisiana	19,019	19,019	0
Maine	19,019	19,019	0
Maryland	19,020	19,020	0
Massachusetts	19,020	19,020	0
Michigan	19,019	19,019	0
Micronesia	0	0	0
Minnesota	19,019	19,019	0
Mississippi	19,019	19,019	0
Missouri	19,019	19,019	0
Montana	19,020	19,020	0
Nebraska	19,020	19,020	0
Nevada	19,020	19,020	0
New Hamphshire	19,020	19,020	0
New Jersey	19,020	19,020	0
New Mexico	19,020	19,020	0
New York	19,019	19,019	0
North Carolina	19,019	19,019	0
North Dakota	19,020	19,020	0
Ohio	19,019	19,019	0
Oklahoma	19,020	19,020	0
Oregon	19,020	19,020	0
Pennsylvania	19,020	19,020	0
Puerto Rico	19,020	19,020	0
Rhode Island	19,020	19,020	0
South Carolina	19,020	19,020	0
South Dakota	19,020	19,020	0
Tennessee	19,019	19,019	0
Texas	19,019	19,019	0
Utah	19,020	19,020	0
Vermont	19,020	19,020	0
Virgin Islands	0	0	0
Virginia	19,019	19,019	0
Washington	19,020	19,020	0
West Virginia	19,020	19,020	0
Wisconsin	19,019	19,019	0
Wyoming	19,020	19,020	0
Northern Mariana Islands	0	0	0
Sub–Total	970,000	970,000	0
Special Projects	1,500,000	1,750,000	1,000,000
Total	2,470,000	2,720,000	1,000,000

APPROPRIATION FOR PAYMENTS TO THE 1890 LAND-GRANT COLLEGES
AND TUSKEGEE UNIVERSITY, 1992 - 1994

INSTITUTIONS	FY 1992	FY 1993	FY 1994
Alabama			
Alabama A&M University	1,274,488	1,274,488	1,421,686
Tuskegee	1,274,488	1,274,488	1,421,686
Arkansas			
University of Arkansas	1,152,100	1,152,100	1,282,216
Delaware			
Delaware State College	416,484	416,484	463,281
Florida			
Florida A&M University	1,061,531	1,061,531	1,213,967
Georgia			
Fort Valley State College	1,528,392	1,528,392	1,723,950
Kentucky			
Kentucky State University	1,913,376	1,913,376	2,161,014
Louisiana			
Southern University and A&M College	1,057,358	1,057,358	1,178,693
Maryland			
University of Maryland Eastern Shore	811,485	811,485	908,330
Mississippi			
Alcorn State University	1,261,610	1,261,610	1,396,633
Missouri			
Lincoln University	1,912,073	1,912,073	2,157,479
North Carolina			
North Carolina A&T State University	2,288,585	2,288,585	2,550,760
Oklahoma			
Langston University	1,144,629	1,144,629	1,287,380
South Carolina			
South Carolina State College	1,111,690	1,111,690	1,249,323
Tennessee			
Tennessee State University	1,728,786	1,728,786	1,930,914
Texas			
Prairie View A&M University	2,346,393	2,346,393	2,672,517
Virginia			
Virginia State University	1,457,332	1,457,332	1,633,611
Sub-Total	23,740,800	23,740,800	26,653,440
Federal Administration	989,200	989,200	1,110,560
Total	24,730,000	24,730,000	27,764,000

TABLE II
APPROPRIATION FOR PAYMENT TO STATES
BASIS OF ALLOTMENT AND MATCHING REQUIRED
FISCAL YEAR 1994

ITEM	TOTAL ESTIMATE 1993	ALLOTMENT	AMOUNT PAID W/O MATCHING	AMOUNT REQUIRED MATCHING
Smith-Lever Act:	270,000,000			
Section 3(b)		56,475,091 -fixed by Sec 3b PL 87-749	14,513,808	41,961,283
		1,544,909	--	1,544,909
Section 3(c)		(177,275,000)	7,959,000	169,316,000
		67,926,400 -farm pop.		
		67,926,400 -rural pop.		
		34,463,200 -equally		
		6,959,000 fed admin. & coord. Sec 3c.1		
Fed Employees Retirement System		4,000,000 -Fed'l contirbution	4,000,000	--
Retirement & Employees Compensation Cost		15,252,000 -Fed'l contirbution	15,252,000	--
Penalty Mail		15,453,000 -Reimbursement to US Postal Sevice	15,453,000	--
Section 3(d)	111,756,000	61,913,640 -EFNEP	62,201,000	--
		287,360 -Fed'l Admin.		
		8,565,000 -IPM	8,565,000	--
		11,375,000 -Water Quality	6,292,500	5,082,500
		3,405,000 -PIA	3,405,000	--
		12,000,000 -YAR	--	12,000,000
		2,000,000 -Food Safety	--	2,000,000
		7,060,000 -Nutr. Education	7,060,000	--
		1,000,000 -Farm Safety	1,000,000	--
		950,000 -Rural Dev. Centers	950,000	--
		3,000,000 -Sustainable Agr.	3,000,000	--
		200,000 -New Uses	200,000	--
Titlle XIV, Food/Ag Act 1997, as amended, 1890 Colleges	27,764,000	(27,764,000)	27,764,000	--
		1,110,560 -Fed'l Admin.		
		26,653,440 -To 1890 Colleges & Tuskegee		
Renewable Resources	3,841,000	3,841,000	3,841,000	--
1890 Facilities	8,000,000	7,680,000 -To 1890 Colleges & Tuskegee	8,000,000	--
		320,000 -Fed'l Admin.		
Rural Health	2,000,000	2,000,000	2,000,000	--
Ag. Tele.	1,221,000	1,221,000		1,221,000
D.C. Public Postsecondary Education Reorganization Act	1,038,000	(1,038,000)		
		41,520 -Fed'l Admin.	41,520	996,480
		996,480 -To Univ. D.C.		
SUBTOTAL	425,620,000	425,620,000	191,497,828	234,122,172
Fed'l Admin	5,644,000			
Total FY-1993	431,264,000			

STATUS OF PROGRAM
EXTENSION SERVICE

The Cooperative Extension System, a national educational network, is a dynamic, organization pledged to meeting the country's needs for knowledge and educational programs that will enable people to make practical decisions. Its mission is to help people improve their lives through an educational process that uses scientific knowledge focused on issues and needs. Recent significant accomplishments include:

PRODUCTION AGRICULTURE

Sustainable Agriculture Research and Education (SARE)

The Extension Service-USDA, in conjunction with the Cooperative State Research Service-USDA, has implemented the Agriculture Productivity Research Subtitle of the 1985 Food Security Act. This legislation, initially referred to as Low-Input Sustainable Agriculture (LISA), has resulted in funding 78 LISA projects in 1988 and 1989. Now, in 35 or more states, the Extension System offers Sustainable Agriculture Research and Education programs that seek to strike a balance between short- and long-term economic and environmental factors.

Water Quality

Extension education programs on water quality help agricultural producers, households, communities, and local and regional jurisdictions attack problems and potential problems of surface and groundwater degradation. Here are representative accomplishments of the Extension System water quality program.

- *Nutrient management*: Maryland's nutrient management program, covering 112,320 acres of cropland and employing 14 county-based consultants, reduced N by an average of 35 lbs. per acre, P205 by 41 lbs., and K by 32 lbs. Statewide, this translates into potential reductions of 3.9 million lbs. of N, 4.6 million lbs. of P205, and 3.6 million lbs. of K entering the environment.

- *Animal waste management:* In Arkansas, 1,100 poultry producers improved manure storage and application; in Delaware 19 broiler producers adopted dead bird composting; and in Connecticut 5 poultry producers reduced water flow to manure holding areas.

- *Pesticide management:* In 1991, 62% of the Illinois corn acreage and 59% of the soybean acreage was included in IPM programs. Compared with 1985, the rate of active ingredient use in 1990 was reduced by 22% for soybeans, and 14% for corn.

- *Drinking water/wellhead protection*: In Tennessee, 11,600 households with septic tanks reduced the toxicity of chemicals used.

- *Public policy education:* In New York, to build coalitions and apply public policy principles to water quality education, Extension conducted two workshops for state legislators and a regional key informant survey. In 11 counties, Extension established coalitions that developed local water quality strategies.

In 1992, Extension, EPA, and SCS established a University of Wisconsin-based team to actively assist interested states use **Farm*A*Syst**, an environmental audit instrument, in identifying farmstead sources of pollution through voluntary risk assessment and education. Fifteen Southern States have already been trained in using Farm*A*Syst.

In 48 states and Puerto Rico, 74 interagency hydrologic units are demonstrating how water quality can be improved through soil nutrient and chemical management and proper storage, handling and use of animal wastes and pesticides. Projects in 16 states demonstrate and accelerate the adoption of "state of the art" agricultural production practices and cost-effective systems that reduce loadings of agricultural nonpoint source contaminants. Hydrologic unit and demonstration project accomplishments are reported in "Educational, Technical, and Financial Assistance for Water Quality: 1991 Report," published by the Agricultural Stabilization and Conservation Service, Extension Service, and Soil Conservation Service.

Other Production Agriculture Education Programs

PLANETOR and other sustainable agriculture programs have been initiated in approximately 40 states. Farmers, researchers, USDA agencies and other public and private organizations with a stake in developing globally competitive agricultural systems in the U.S. cooperate to manage systems that are economical, environmentally sound, and socially acceptable.

The **Food Animal Residue Avoidance Databank** (FARAD), an expert-mediated decision support system, provides information on residues following the treatment of food animals with drugs and pesticides in order to prevent them from entering the food chain. FARAD annually publishes updated and inexpensive books for all of the major species of food animals and sells over 5,000 copies each year.

In a time when approximately one half of the farms had negative net income and ten percent were leaving farming, Extension education on **farm financial planning** and **stress management** reached families in nearly all states. Nearly 83 percent of the participants in a farm financial planning program had no difficulty obtaining credit and 55 percent maintained or increased their net worth. A 10-state study in 1990 showed that the average estimated benefit per farm family over a 5-year period was $20,000.

Every State Extension Service has committed staff and facilities to implement **Integrated Pest Management** (IPM) programs. In FY 1990, 900 Extension-sponsored IPM educational programs provided training for 11,000 IPM scouts and over 45,000 agricultural producers. As a result, Extension directly influenced pest management strategies used by 150,000 agricultural producers on 11 million acres of cropland. Nationally, users of integrated pest management practices had net returns of $578 million higher than non-users. Also, nearly two-thirds of private consulting firms reported that Extension was a primary source of research-based information on pest management.

Since 1975, when the **pesticide applicator training** program began, Extension has trained over 2.5 million private and commercial applicators. On a yearly basis, Extension will train over a half million pesticide applicators. Extension training meets the requirements of each state regulatory agency and is continually updated to reflect new technology and issues concerning pesticide safety and use.

The Extension **Pesticide Impact Assessment (PIA)** program documents the benefits of pesticide use to agriculture and quantifies the impact of pesticide regulation to agriculture. Land-grant institutions in all states and six territories collect information that is organized and published primarily for the Environmental Protection Agency in its regulatory capacity. Federal funds are used for several purposes: supporting State PIA programs; conducting commodity assessments and assessments of pesticide active ingredients; gathering essential pesticide-use data; and obtaining yield and quality changes in agricultural production related to different pest-management technologies. Since the program began in 1976, over 40 assessments have documented the benefits and risks of pesticides.

Extension has worked with researchers, farmers, ranchers, processors, and distributors to develop **New Products**, technology, and social science databases. For example, the shiitake mushroom project in Virginia has focused on production and marketing of a new product, shiitake mushrooms. Over 200 landowners in Virginia have established a commercial mushroom production enterprise on their farms. In 1991, over 600,000 pounds of shiitake mushrooms worth $300,000 wholesale were grown and sold.

For other examples, the Minnesota Center for Alternative Plant and Animal Products, in cooperation with ES/USDA, the National Agricultural Library, and others, is developing a database as an instantaneous resource for developing educational materials on the production and commercialization of alternative crops and products. North Carolina, in cooperation with ES/USDA, is developing a research and knowledge taxonomy for alternative agriculture opportunities.

RURAL INDUSTRIES

Community Resource and Economic Development

Extension instructs small business owners and local officials on strategic economic development. Educational programs guide local decisionmakers in understanding issues, making sound decisions, developing strategies, managing their implementation, and evaluating outcomes. Extension targets small businesses and agricultural firms for training, technical support, enterprise development, and market development. Related programs foster community economic analysis, international trade, community planning and rural tourism development.

o A research and extension thrust by Cornell University established the Innovative Industrial Extension System to support New York industries in adopting new technologies and foster in-house training programs among businesses. Some 4,000 businesses have been counseled, 2,000 jobs were created due to expanding business, and energy audits of 21,000 firms experienced industrial energy conservation.

o The Kentucky Cooperative Extension Service launched a concerted manpower development and assistance effort for farmers and those who do not rely on agriculture as a source of income. Extension trained 50 community leaders, improved job skills among 16,000 residents, and assisted 600 farmers in manpower development.

Forestry in Rural Development and International Trade

Extension educational programs in forestry have benefitted many. Here are selected examples:

o An Alabama Forest Products Development Center focuses on international trade opportunities, value-added manufacturing and new product technology. The Center participated in 11 conferences pertaining to rural economic development and two trade shows, initiated two foreign investment missions to Europe, hosted six investor group visits to Alabama communities and met with six local economic development groups. The Center developed 145 trade leads, and conducted two wood industry feasibility investigations.

o Extension education programs in North Carolina increased processing efficiency by $1 million, created 50 new jobs in industry, stimulated $7 million in new wood industry investments, and improved quality control in 65 sawmills.

o Five New Hampshire firms which received assistance in grade and lumber recovery

recovered $50 thousand in additional value per year. One firm reduced losses from lumber stain by $250 thousand. A biomass energy firm saved $375 thousand per year through better fuel management. Another firm saved $400 thousand through better drying and process control.

- Over 100 Vermont foresters, loggers, landowners and public officials learned methods of economic and environmentally sustainable timber harvesting. As a result, downstream sedimentation from stream crossings by logging equipment decreased. Public perception of timber harvesting improved with increased awareness of environmentally acceptable harvesting practices. Injuries, lost time, and lost earnings due to a logging accidents decreased by five percent.

International Marketing

The Cooperative Exension System, University International Trade Development Centers, State Departments of Agriculture, Small Business Administration and other cooperators, implemented 44 **Trade Information Systems (TIS)** in 13 States in 1990. As a result, 500 companies were contacted relative to trade opportunities, 50 rural businesses participated in the TIS network, and firms were assisted in obtaining market leads and given guidance on obtaining services to capitalize on these leads.

The **AgLink** program matched smaller U.S. agribusinesses with counterparts from abroad to explore joint business efforts. Extension cooperates with staff of the Office of International Cooperation and Development (OICD), FAS officers overseas, and others to bring agribusiness entrepreneurs from abroad to meet with interested U.S. agribusiness heads. The 87 appointments with agribusinesses from four Nations, a result of AgLink '91, were so well received that AgLink '92 was held in September 1992. North American Free Trade Agreement discussions will draw special participation by Mexican agribusinesses. The AgLink model is being developed into a package for independent production and use by State Extension Services.

Extension Collaboration in Poland

ES-USDA is collaborating with Poland's Ministry of Agriculture and Food Economy in restructuring and reorienting Poland's Extension Service to work closely with private farmers, producer associations, and rural communities to provide them with the skills necessary to operate successfully in a free market economy. The project is guided by a director and two administrative and program support specialists working in Warsaw. Additionally, fifteen teams of two U.S. Extension specialists with economics training and county-level programming expertise have been assigned for six-month periods to regional agricultural offices across Poland to train Poles in Western-style business and organization practices, more efficient farm management, and marketing.

This project has been described by the Polish government as the most successful effort of any country to assist them in their transition to political democracy and a market economy. To date, more than 17 land-grant universities have cooperated with ES in providing 6-month field teams in 14 Polish provinces. Similar projects began in Armenia in July 1992 and are proposed for Bulgaria, Russia, Kazakhstan and Uzbekistan in the former Soviet Union.

NATURAL RESOURCES

Conservation and Management

The Cooperative Extension System's educational programs for conservation and management of natural resources focus on management, use, and sustainability of natural resources with special attention to environmental stewardship and biodiversity. They provide information on soil, water, air, and plant management; fish and wildlife management; aquaculture; forestry, sustainable use and management of rangelands, wetlands, and wildlands; and land use planning.

Programs under the **Renewable Resources Extension Act** assist private landowners and public land managers with conservation techniques, tree improvement and financial analysis. Through this program Extension provides approximately 600 staff years of natural resource programming annually. This effort over a 5-year period resulted in the following accomplishments:

- 400,000 private non-industrial forest landowners contacts.
- 21 million acres of improved forest land management.
- $160 million increased revenue from forestry and wildlife management practices.
- 23,000 forest industry worker assists.
- 1,600 wood processor assists.
- $48 million in savings through improved forest industry efficiency.
- 100,000 contact hours of continuing education training for 25,000 natural resource professionals.
- 50,000 environmentally trained teachers.

Environmental Education

Extension conducts environmental education programs to help people gain knowledge and appreciation for environmental and forest stewardship, as well as for their communities, schools, and homes. These wide-ranging programs encourage soil and water conservation; multiple use of land, forest and water resources; and protection of water, wildlife and other natural resources. Extension program participants reduced purchases of hazardous materials by 61 percent, used 52 percent less toxic products and 50 percent participated in "Community Clean Sweep" programs to collect and dispose of hazardous wastes.

In 1991, 4-H and Youth Development involved 1.2 million youth in natural resources and environmental education programs focusing on wildlife habitat, stream protection and enhancement, threatened and endangered species, recycling, energy conservation, water and air quality, forestry, range management, and soil conservation, and more. 4-H Clubs around the country have won local, state, and national awards for adopt-a-stream and adopt-a-highway projects to enhance our environment. More than just community service projects, these projects entail experiential learning that is associated with comprehensive educational programs.

Wildlife and Fisheries Continuing Education Programs

Extension conducts programs for professional natural resource managers and private landowners/managers on habitat management, wetlands, damage prevention/control, endangered species protection/management. Continuing education programs provide management assistance on over 200 million acres of privately owned wildlife habitats. Extension also offers an extensive list of educational materials (e.g., publications, videotapes) for use by private landowners and managers.

Waste Management

Extension education on waste management trains individuals, households, businesses, and communities to make environmentally responsible consumption and waste management decisions to reduce the waste stream and disposal of hazardous wastes, and increase recycling. In all regions of the country, Extension provided information and technical assistance for local officials and individuals in dealing with the problems of increased waste volume and closing landfills.

In Massachusetts, where 26 rural towns were faced with skyrocketing disposal costs and restricted budgets, Extension provided leadership and facilitated citizen involvement in the formation of a 50-member planning board that led to the development of the largest solid waste district in the state. Hazardous waste coordinators, designated and trained as part of the program, have been effective in establishing hazardous waste collection days that are receiving increased local government commitment.

Extension education is making major reductions in the solid waste stream. In Montgomery County, Ohio, for example, the 40,000 tons of grass collected in 1989 was reduced to 15,000 tons in 1990, saving the county $650,000 in trash disposal costs. In Florida, as a result of an Extension program, blue crab waste is mixed with wood processing wastes to form a rich compost product, reducing the amount of crab waste entering landfills by 13 tons daily.

4-H and Youth Development

Extension builds lifelong learning skills that develop the potential of youth. Exploring such topics as science, technology, and citizenship, 4-H youth acquire self-esteem, new knowledge, and problem solving skills. Programs teach stress management, self-protection, parent-teen communication, personal development, careers and global understanding. For example, to increase the financial management literacy of American youth, the Extension Service-USDA formed a partnership with the College for Financial Planning, Denver, originator of the High School Financial Planning Program. During the 1991-92 school year, Extension taught the six part curriculum to approximately 65,000 high school students in 34 states, working though high school teachers and the 4-H/youth program.

Youth and Families At Risk

Youth-at-Risk programming focuses on school-age child care and education, collaborations that support community programming for high risk youth, and the development of literacy and technological literacy in youth-at-risk. With $7.5 million of federal funds in FY 1991 and $10 million for FY 1992, matched by state and local sources and additional amounts from private sources, Extension operates Youth-at-Risk programs at 95 sites located across the nation.

Emphasis is being placed on the visible problems of school dropouts, substance abuse, and teen-age pregnancy by encouraging youth at risk in rural and urban areas to develop positive self-concepts and raise their self-esteem through education. Programs are being expanded to stress the importance of highway safety and to promote cultural awareness and career exploration. Collaborating agencies include housing and social services agencies and the medical community, including the U.S. Departments of Housing and Urban Development, and Health and Human Services. Funding and other resources received from these agencies have expanded Extension programming significantly. For example, Boston recently requested that Extension start up at least 22 4-H clubs in 11 inner-city neighborhoods.

PROGRAMS FOR URBAN AND LOW-INCOME AUDIENCES
PROGRAMS FOR CONSUMERS
PROGRAMS WITH SOCIAL IMPACTS

Urban Gardening

There are 23 urban gardening programs in such cities as Los Angeles, New York, Philadelphia, St. Louis, Detroit, and Atlanta. These programs teach people to produce and use vegetables so they can eat more nutritiously. In Los Angeles, more than 20,000 people have participated in the gardens, workshops and school projects since Common Ground began in 1977. During this time, fresh vegetables with an estimated retail value of almost $4 million were made available to families who otherwise could not afford them.

Indian Program

In 1991, ES-USDA established educational programs to serve 15 reservations, reaching over 84,000 Indians and Alaskan Natives, with a Congressional appropriation of $1,000,000. In 1992, with $1,500,000 funding, the number of programs serving reservations was expanded to 28. Extension programs vary from providing literacy skills to latchkey children at Ft. Hall, Idaho, to developing a diabetes dietary garden with the Choctaw Indians in Mississippi; and from teaching subsistance agriculture to residents of 43 native villages in interior Alaska to developing arid agriculture on the Hopi Reservation in Arizona. Each dollar of federal funding, on average, has attracted $0.37 of Tribal support and $0.41 of state and local Extension support.

Food Safety and Quality

Extension food safety education provides research-based information on issues of current concern and improves skills in safe handling and preparation of foods in businesses, institutions, and the home. Teaching the basic principles of food safety, Extension annually answers approximately 6 million telephone inquiries, reaches 45 to 50 million through the media, distributes several million fact sheets, and reaches 10 million individuals through workshops and other means.

Through education, people are improving their understanding of risks and are adopting recommended food handling practices. Extension teaches the Hazard Analysis and Critical Control Points (HACCP) system in programs for producers, processors, and consumers. Materials for training food service workers have been made available and interdisciplinary teams have identified models for strengthening programs. Through the Food Safety and Quality efforts, development of model programs and materials was enhanced in 1992 with $1.5 million in targeted Federal annual appropriations.

Expanded Food and Nutrition Education Program

The Expanded Food and Nutrition Education Program (EFNEP) teaches thousands of low-income families about food selection, sanitation, and kitchen and food safety. In the past 3 years EFNEP has emphasized working with low income pregnant and parenting teens and adults through programs such as "Have a Healthy Baby" in Indiana, "Great Beginnings" in New Hampshire, and "Teen-age Mothers" in Georgia. Initial evaluation data show improvements in birth weights of babies and improved health practices of mothers.

For FY 1991, EFNEP funding increased by about 3 percent. In turn, the number of families reached increased by 12 percent (232,178 versus 206,657 in FY 90) and the number of youth by 11 percent (482,586 versus 434,823 in FY 90).

Health

To foster health-related prevention and intervention techniques, Extension education emphasizes the importance of checkups and early screening for cancer, nutrition for good health, reduction of stress, and improving safety in the workplace and at home. Extension reaches audiences through health fairs, satellite conferences, and seminars with some targeted toward low-income families and the elderly. Many efforts are conducted in cooperation with the American Heart Association, the American Cancer Association, mental health centers, and other organizations. Research on accidents and fatality rates has improved training on trauma injuries at work and in the home for farmers, families, and medical personnel. Other programs assist families and the elderly in analyzing the benefits and costs of health insurance and long-term care.

The **AgrAbility Project** was established under the 1990 Farm Bill to help all agricultural workers with disabilities improve their capability of continuing to farm and ranch and keep the emphasis on these peoples' abilities. In 1991, its first year of funding, the AgrAbility Project has assisted hundreds of farmers, ranchers, and others with disabilities including their families; educated thousands of professionals in agriculture, health, and vocational rehabilitation on agricultural worksite adaptations; and generated public awareness through displays and presentations at fairs, farm shows, and conferences.

Farm Safety

Extension has trained over 17,000 professionals in farm accident extrication procedures and nonprofessionals in first on the scene emergency response procedures. These programs are critical to reducing the risk of injury to the rescuer, reducing the severity of the injury to the accident victim as well as emphasizing the value of accident prevention.

Elderly

Programs for the elderly address issues ranging from adjusting psychologically to retirement and increasing the ability to live independently in later years to identifying housing options and making after-death arrangements. "Linkage Workshops" train professional care-givers and family members to work together and with federal, state, and local agencies in providing care. Over 1,200 low-income people over age 55 gained employment, as a result of training by Maine Cooperative Extension with a grant from the National Council on the Aging.

Family Financial Management

Extension programs are targeting limited resource families in 35 states in 1992 for financial management education. Families report increased control over finances, debt reduction, and savings as major accomplishments.

In one state last year, Extension taught more than 15,000 homemakers how to complete a tax return. More than $10.5 million have been received in tax refunds and earned income credits. The average tax refund per family in 1991 was $600. Approximately two-thirds of the learners had annual incomes of less than $6,000.

Parenting Skills

To reduce academic, physical, social and emotional problems among children, Extension provided parent education to over 530,000 adults in 22 states during 1990. Many states target prospective parents, teenage parents, parents with limited resources, single parents, parents in blended families, parents at risk of abusing and neglecting their children, and child care

providers.

Extension's Response to Families and Desert Storm

Extension moved quickly to address the needs of military families and communities affected by the Middle East crisis. Curriculum and other educational materials were compiled in Extension's national family data base (**PENpages** located at Penn State University). In one month alone, Extension staff throughout the nation accessed the database over 3,650 times for documents on helping families cope with the stress of Desert Storm.

Extension teaches military families how to deal with domestic crises. These include child and spousal abuse prevention; strengthening army families during relocation and transition; coping with mobilization, deployment, and reunion; and financial management. These programs are funded through agreements with the Department of Defense.

Family Community Leadership

The Family Community Leadership (FCL) program, with support from Extension and private sources, operates in all states, Puerto Rico, and Guam. FCL offers educational opportunities that prepare participants for involvement in public policy decision making, by acquiring skills in communication, working with groups, issue analysis and resolution, community affairs and public policy, and volunteerism and teaching methods. Large numbers of volunteers are trained and, in turn, invited to participate in leadership development opportunities that pay large dividends in their communities and personal lives. In Chicago, the FCL is training 5,400 school district volunteers.

Volunteerism

Across the nation, Cooperative Extension agents work each year with nearly 3 million volunteers who, in turn, work with about 48 million other adults and youth. Volunteers invest about 51 days for every day an Extension professional invests in working with volunteers. The value of volunteers' time is five times greater than the combined Federal, state and local funding.

Electronic Education

In recent years, Extension has accelerated use of electronic technologies and information processing standards to speed information over a wide variety of mediums. Today's Extension client has access to more information and receives it more rapidly and efficiently than ever before.

To satisfy specific information needs within a variety of agricultural and other subjects, a large number of Extension staff and clients rely on computer-based information services, such as PENpages and Almanac. PENpages is a computer-based information service containing thousands of reports, newsletters, and fact sheets that are accessible to people at their homes and offices. Almanac is an inter-network information server that answers requests for information submitted through electronic mail. Almanac allows clients to receive reports, newsletters, journals, articles, sounds, and graphic images.

Videoconferencing allows Extension educators to communicate with diverse audiences on significant topics and concerns. The Agricultural Satellite Network (AG*SAT) links many of the land-grant colleges and universities of the Cooperative Extension System, enabling learners, researchers, and the Extension workforce to communicate via satellite. For example, more than 175 downlink sites participated in the "Investing in the Future: Counties Respond to America's Aging Population and Aging Infrastructure" videoconference. Joining the National Association of Counties (NACo) and Extension as cooperators in the videoconference were the U.S. Administration on Aging and the Federal Transit Administration.

WEDNESDAY, MARCH 10, 1993.

NATIONAL AGRICULTURAL LIBRARY

WITNESSES

JOSEPH H. HOWARD, DIRECTOR, NATIONAL AGRICULTURAL LIBRARY
MARIA G. PISA, ASSISTANT DIRECTOR FOR POLICY AND PLANNING
STEPHEN B. DEWHURST, BUDGET OFFICER

Mr. PETERSON. We would like to welcome Mr. Howard, Ms. Pisa and Steve Dewhurst here. Mr. Howard, your statement will be entered into the record as submitted. You are free to make your presentation in any fashion you wish.

OPENING REMARKS

Mr. HOWARD. I will summarize for the record, Sir, knowing that the total will be in the record.

First of all, I will begin by saying that I am sorry that the Library has not had a chance to develop super slurpers and diapers, but I would like to make sure that you know that we work very closely with ARS and other scientists around the world to provide them the information necessary to be able to develop these. So we feel like, while we don't get credit for it, we do provide the scientists with information that is fundamental to their research and in doing so ensure that there is no duplication of effort. So we are very proud of the super slushers and our cohorts at ARS.

NAL is an agency of the U.S. Department of Agriculture and was established in 1862 under legislation signed by President Abraham Lincoln. In the simplest terms, NAL's role is to gather, maintain, and make accessible the agricultural information and knowledge that is necessary to assure that the United States stays the most productive agricultural nation in the world.

This information is used by many, including the Nation's scientists, researchers, university professors and students, government leaders, agribusiness leaders, farmers, and consumers. In their research and decision-making, these people depend on NAL to have the most comprehensive collection of agricultural knowledge available anywhere.

With the Library of Congress and the National Library of Medicine, we are one of three national libraries in the United States. NAL also serves as a departmental library for the U.S. Department of Agriculture, serving USDA employees worldwide.

NAL, with a collection of over 2 million volumes, is the largest agricultural library in the world. The size of the NAL collection is perhaps best imagined when one considers that we have 48 miles of book shelves.

The collection is not only books and periodicals. It also includes photographs, slides, films, videotapes, theses, patents, software, op-

tical discs and artifacts. Since the collection grows at a rate of approximately 25,000 items a year, we are fast approaching the point where we will run out of shelf space.

NETWORKING

Although NAL does not have field offices, it does serve as the coordinator and primary resource for a nationwide network of state land-grant university libraries and field libraries of various USDA agencies. NAL, together with these other libraries, operates a regional document delivery service which provides access to agricultural and scientific documents to USDA researchers across the country.

NAL and land-grant libraries also collaborate on programs to improve access to and maintenance of the Nation's agricultural knowledge. In recent years, this has been done more and more frequently through the application of electronic technology such as text digitizing, laser disc, and CD-ROM.

AGRICOLA, which stands for Agricultural OnLine Access, is NAL's bibliographic database providing quick access to the NAL collection. AGRICOLA contains 3 million citations to agricultural literature, and is known by users of agricultural information worldwide. It is widely available on line or on compact disc.

INFORMATION CENTERS

Another important part of NAL's activity is our group of information centers. These centers provide in-depth services ranging from responding to reference requests and developing publications, to establishing dissemination networks.

Subjects covered by these information centers are agricultural trade and marketing, alternative farming systems, animal welfare, aquaculture, biotechnology, food and nutrition, plant genome, rural development, technology transfer, water quality, and youth development.

Topics covered by NAL's information centers respond to research, business, and consumer interests. NAL's Rural Information Center, for example, is involved very directly in the revitalization of rural America at the grass roots level. I would like to explain what I mean when I say that NAL serves rural communities directly.

RAPID RESPONSE

A county extension agent in New Mexico came to NAL for assistance when he discovered that a 36-year-old X-ray machine at De Baca General Hospital was too outmoded to produce legible film. Using information about grant-seeking strategies and application procedures identified by NAL's Rural Information Center, the extension agent was successful in obtaining a half a million dollars in State and Federal grants to update the hospital's basic surgical equipment. Equipped with a new X-ray machine, fetal heart monitor, heart defibrillator, and other surgical equipment, a greatly improved health care capability was brought to an isolated rural community.

Another NAL success story involves enhancing the economic base of a rural area. A regional development association in the Southwest sought assistance from the NAL Rural Information Center in identifying potential uses of zeolite. Using literature searches and articles furnished by NAL staff, six commercial markets for this product were identified. Once the development organization determined that a local mining company could, indeed, be profitable mining large quantities of zeolite, 12 local employees of this company retained their jobs. In fact, the project became so successful that other institutions began further research in the area of zeolite use, which may generate new jobs in rural areas.

I think that most would agree that agriculture holds the key to the Nation's continued prosperity. I would like to take a step further and state that the hundreds of years of agricultural information gathered and maintained by NAL holds the key to continued prosperity of U.S. agriculture.

Most recently, USDA was faced with a situation which poignantly illustrates the importance of the information maintained and made available at the Library. Of course I am referring to the tragic outbreak of food poisoning caused by the E. coli bacteria in the Northwest. This resulted in thousands of requests for information from the NAL collection.

NAL staff were able to respond quickly to these requests through its AGRICOLA database. Within minutes, NAL staff was able to provide a thorough listing of E. coli bacteria literature and copies of listed articles to USDA officials. NAL followed up on this activity by producing a bibliography on E. coli bacteria and making it available, free of charge, nationwide.

NAL's acquisition and rapid access to this and all other agricultural research serves to aid scientists to respond to these and other important national needs. NAL routinely responds to such needs, not only from USDA, but also from throughout the Nation's agricultural community. This type of service is the backbone of our operations.

NAL is making optimum use of its 1993 appropriation; but with the cost for journal subscriptions increasing at the rate of 15 percent annually and the cost of other library materials increasing at approximately 20 percent annually, we are experiencing a drop in our ability to obtain scientific and technical literature. Moreover, the cost of providing document delivery services has escalated in the last several years to the point where we had to curtail other programs to meet these costs.

However, NAL continues to provide services to its fullest capability and has made significant inroads into the use of new technologies in information management.

INFORMATION TECHNOLOGY

The text digitizing program is just one example of many illustrating how NAL is shaping the latest in electronic information management technology so that the Library can better serve the Nation. I think all of you have you a copy of our brochure which is a recent report of the text digitizing project that we have presented to you in previous years.

The National Agricultural Text Digitizing program enables NAL and land-grant university libraries to work together in producing and distributing to libraries nationwide whole sections of the NAL collection on CD-ROM. The program began in 1986 as an effort of NAL and the land-grant libraries to examine and develop ways that the rapid advances in electronic information management could be applied to increasing access to agricultural information. Under NAL's leadership the program has expanded from 2 libraries to 46 libraries. CD-ROM products have been developed to cover aquaculture, international agricultural research, Agent Orange, acid rain, the journals of the American Society of Agronomy and selected papers of the George Washington Carver papers at Tuskegee University.

Seizing the CD-ROM technology, NAL, in related projects, has developed and distributed other discs covering the subjects of food irradiation and ornamental horticulture. Working with the USDA's Extension Service, we developed a disc of general agricultural information for use by county extension agents in responding to millions of calls that the agents receive each year.

In addition to maximizing the use of the comprehensive collection of agricultural knowledge at NAL, CD-ROMs and other types of electronic information management technologies hold great promise for NAL as we wrestle with the insidious problem of preserving large portions of our collection.

PRESERVATION OF LIBRARY MATERIALS

Preservation of materials is an area of huge concern to the world's libraries. Because of the acid contained in the paper on which most of the old books and documents were printed, the books and documents are literally turning to dust. A preservation study of the NAL collection conducted in 1989 showed that 50 percent of the monographs and serials are disintegrating and more than one-fourth of the volumes are brittle and can barely be used.

NAL sees the issue of preservation of the Nation's agricultural literature as a key focus for the Library for the foreseeable future. Meeting this threat to the Nation's agricultural information, while trying to maintain the level of service we provide to our traditional users, will be a challenge that we will be addressing.

The problem of preserving the collection may be compounded by something I mentioned earlier in my remarks, and that is that NAL is running out of space to store agricultural materials. Miniaturizing some of the material in electronic form holds the greatest promise in dealing with this lack of space and could possibly be used to deal with the Library's preservation problems also.

I would like to end by saying that, with the information maintained and provided by the NAL, the citizens of this Nation can be assured that access to agricultural information found at NAL will continue to assure that the United States will remain in the forefront of world agricultural affairs. I think that our track record at NAL shows how much we can accomplish.

Thank you very much. And I am happy to answer questions that you might have.

[CLERK'S NOTE.—Mr. Howard's prepared statement appears on pages 412 through 421. The budget justifications, which were received on April 28, 1993, appear on pages 422 through 439.]

USER FEES

Mr. PETERSON. I appreciate your testimony because I wasn't really that well versed in what you do. And, frankly, I still don't know where you are located.

Mr. HOWARD. We are in Beltsville, Maryland. We have a 14-story building on Highway 1, across from the Agricultural Research Service.

Mr. PETERSON. Obviously, I've learned something today. I am interested if, in regard to the services that you are performing, there is any income from your operations? Are there any fees charged for sending documents? Or are there any fees associated with any of the work you do?

Mr. HOWARD. Let's say that, as far as income, it is negligible. We do charge to recover a small portion of the costs for photocopy and inter-library loan. Some libraries provide it free of charge, but we do not have the money.

And our document delivery, which is a major part of our work, comes to maybe 200,000 requests a year. And we do charge the cost of photocopying documents. And we do charge for some of the reference questions that involve indepth research. But it is negligible as far as income generation.

Mr. PETERSON. In your statement, you made a special point to suggest that you are running out of space to store agricultural material. Can you give us a little bit more detail? Expand that a little bit. How acute is the problem? Is it in an emergency state?

Mr. HOWARD. The study that we had made two years ago with funds from your committee tells us that we will be out of space in the Library in three years. The report said five, but that was two years ago. So we will be out of space in three years. And we have had various plans to try to solve that, none of which have been successful in times of short funds.

Let me just mention a few of those. Of course one of those is to build a new building. We assume that will not be possible for a while. We will have to get remote storage either through renting remote storage, or building or modifying an existing building. And those are still options that we hold, funding permitting.

One of the things that we are trying to do now is to put a major push on preventing the problem by trying to see if we can work up a plan of receiving things in digital form in addition to—or maybe in lieu of paper. And that takes a lot of study, and we are in the process of making that study now.

So that might help guide our prospective purchases and our prospective gifts and exchanges, but we still have 2 million volumes to house. So the idea, then, is to do something like the text digitizing program, being able to miniaturize materials and get them in digital form. So there are several approaches, none of which, right now, we have the funds for but which we are hopeful that we will be getting.

Mr. PETERSON. Once you miniaturize materials, are you suggesting that you have to keep the original documents as well?

Mr. HOWARD. It depends who you are talking to. In many cases we will not continue keeping the original documents. It somewhat depends on what it is. If it is a rare book, we will probably do both.

But for most of the things, you cannot keep the original because it is in bad shape. Once we turn the page of the Progressive Farmer, for example it is disintegrated. So we want to turn it once and get a picture of it.

So for many things we will be able to discard the original. But there will be certain ones that we will want to keep.

FACILITY DEVELOPMENT

Mr. PETERSON. In the past you have asked for funding for facility development. Are you going to ask for much the same as you have in the past?

And is some of that money to be used for the preservation or the expansion of storage facilities?

Mr. HOWARD. The 1994 budget is unclear to us right now. We do not know what's in there. I do know that we have, through the years, requested money to do that. But we have to wait to see what the status is of the budget request when it comes back to us.

Mr. PETERSON. Have you expended those funds in years past?

Mr. HOWARD. We have never gotten them. We only requested.

REPAIR AND MAINTENANCE

Mr. PETERSON. Last year, you provided the Committee with a list of facility needs and the cost of each project. Please update this list, noting those projects that were completed and the cost of completion.

Mr. HOWARD. I will provide for the record a list of completed projects and costs as well as a list of pending facility needs and the estimated cost of each project. The list of pending needs includes major facility projects we anticipate requiring during the next 2–3 years.

[The information follows:]

Completed Projects [1]

	Amount
Automatic entrance doors, handicap modification	4,668
Restroom renovation (2 each on Floor 1 and Floor 14), including drinking fountains (1 each on Floor 1 and Floor 14), handicap modification	28,725
Front entrance parking space and ramp, handicap modification	3,700
Fire alarm system investigative report	13,944
Testing/structural analysis of south wing roof	5,000
Repair and upgrading of book lift and passenger elevators	645,287

[1] Contract awarded; onsite work completed or in progress.

Major Projects Pending (2–3 years)

	Amount
South wing roof repair	350,000
Freight elevator renovation	141,000
Fire alarm system upgrade	150,000
Fire/life safety features for high rise building (sprinklers, smoke control, emergency phone system)	580,000
Exterior brick/glazing work	100,000

	Amount
Restroom renovation (4), including drinking fountains (2), handicap modification	30,000
Energy saving light fixtures	50,000
Environmental controls for rare books	250,000
Total	1,651,000

BOOK LIFT AND PASSENGER ELEVATOR PROJECT

Mr. PETERSON. The fiscal year 1992 appropriation included $900,000 for replacement of the book lift and upgrading the passenger elevator at your building in Beltsville. As I understand it, a contract was to be awarded in September 1992 with renovation work to be completed over the next 2 years. What is the status of these projects?

Mr. HOWARD. The major portion of fiscal year 1992 repair and maintenance funds were used to award a contract for the book lift and passenger elevator renovation project. This contract was awarded in September 1992. Onsite work on the passenger elevator system began in early February 1993. We expect that work on these projects will be completed by the end of fiscal year 1994.

DOCUMENT DELIVERY COSTS

Mr. PETERSON. Well, keep asking; you might have it one of these days.

In your statement, you mentioned the increasing costs to provide document delivery services to the point you have had to delay some of your deliveries.

How acute is that? And is there a plan to fix that?

Mr. HOWARD. It is very acute. This year we sent out letters to our Department of Agriculture users—particularly, that means ARS—asking that they be judicious before requesting something from us because we are short of funds. I want to say that this shortage of funds for document delivery stems from several problems. One is the increasing costs of the contract to handle our document delivery.

But another is that we have been so successful in improving our services that we have escalated the number of requests that we get. But as I see it, this is a very positive sign that our services are so much better. It also apparently is because of the CD-ROM version of the AGRICOLA database, which lets people all over the world, particularly in the U.S., know what we have.

So, our document delivery situation is serious. And what it means is that we need to be able to get funds to be able to take care of some of those increasing costs.

Mr. PETERSON. What we have to do, then, to take care of this problem is not to allow you to advertise your services.

Mr. HOWARD. I hope that is not probable.

NAL NATIONAL LIBRARY DESIGNATION

Mr. PETERSON. In 1991, the National Agricultural Library was recognized in Federal law as a national library, along with the National Library of Medicine and the Library of Congress. How has this designation changed your responsibilities as a library?

Mr. HOWARD. The 1990 Farm Bill consolidated and expanded the authority for NAL to serve as the primary agricultural information resource of the United States. Some specific provisions of the legislation formally recognize NAL's responsibility to the public, private, and international agricultural information communities, as well as to USDA, and broaden the Library's responsibility within the research and education communities.

The legislation also recognizes and directs NAL's responsibility to cooperate with and coordinate efforts among public and private sector libraries and information centers in the development of a comprehensive agricultural library and information network. This authority, in particular, positions NAL to be more proactive and hence, more responsive to user needs in an increasingly technology-based agricultural information environment.

NUTRITION TOLL-FREE TELEPHONE

Mr. PETERSON. Your 1993 budget request included an increase to establish a toll-free number at the Food and Nutrition Information Center. We are all facing some pretty tight budget constraints and, as you are well aware, we were unable to provide the Library with this increase last year. Were you still able to go ahead and establish this toll-free number?

Mr. HOWARD. No. Without the increase in funding, NAL was not able to establish this toll-free number.

FOOD AND NUTRITION INFORMATION CENTER

Mr. PETERSON. How many calls a day do you receive at the Food and Nutrition Information Center?

Mr. HOWARD. The Food and Nutrition Information Center receives approximately 75 calls a day for food and nutrition information.

FOOD SERVICE MANAGEMENT INSTITUTE

Mr. PETERSON. Last year, you entered into a cooperative trust fund agreement with the Food Service Management Institute. Describe this agreement in further detail and tell us how much you spent in fiscal year 1992 and how much you plan to spend in fiscal year 1993?

Mr. HOWARD. Under the Cooperative Trust Fund Agreement between the University of Mississippi's National Food Service Management Institute, NAL received $45,000 in fiscal year 1992. The agreement also provides for the Library to receive $43,000 in fiscal year 1993. NAL does not provide funding for the Institute.

In exchange for this support, NAL provides document delivery services to school food service and Institute personnel throughout the United States. The Library also provides some cataloging services for school food service management publications which are included in the collection and listed in NAL's AGRICOLA database. NAS also provides clerical assistance, use of materials and information systems, and related support to an Institute employee who is stationed at the Library in Beltsville.

PROGRAM EVALUATION STUDIES

Mr. PETERSON. The Library has been involved in a number of evaluation studies with ARS on library cooperation to improve access to and delivery of information services to USDA scientists. The ultimate goal is to develop an electronic library, whereby scientists would be able to request and retrieve documents from a variety of information providers. What is the status of this initiative?

Mr. HOWARD. The library has been working closely with ARS administration and staff for 5 years, and significant improvements have been made in service to USDA scientists. During that time, three evaluation studies have been completed.

In 1988, a study was completed of the Current Awareness Literature Service (CALS) to assess its value to research scientists and to make appropriate changes in the service. CALS is a selective dissemination of information service that regularly provides scientists with citations to newly-published information related to their research interests.

Earlier this year, a library automation study was completed. That study serves as a blueprint for configuring an ARS library of the future that makes maximum use of electronic linkages to retrieve and disseminate information.

Currently, NAL is completing an evaluation study to assess the information needs of scientists at remote laboratories that do not have library facilities, and to recommend alternatives for meeting those needs. As part of that study, several remote laboratories have had dial-up access to NAL's integrated library system.

Results of these studies are being used by both NAL and ARS to continue to improve access to information for ARS scientists. The improvements that are being made also have a positive effect on other NAL users.

Mr. PETERSON. Were you involved in any evaluation studies with the Agricultural Research Service in fiscal year 1992?

Mr. HOWARD. No new evaluation studies with the Agricultural Research Service were started in fiscal year 1992.

TECHNOLOGY TRANSFER INFORMATION CENTER

Mr. PETERSON. Has the Technology Transfer Information Center identified any trade associations with which to work similar to the exchange that occurred with the Hardwood Industry?

Mr. HOWARD. Yes, the Center is currently involved in discussions with the Equipment Manufactures Institute to conduct a project similar to the hardwood industry. Our goal is to replicate the hardwood industry exchange, and compare and contrast the results. Ultimately, we would like to be able to institutionalize this process within USDA.

WORLD AGRICULTURAL THESAURUS

Mr. PETERSON. You have been working towards a unified world agricultural thesaurus since 1989. What is the status of this initiative and when do you expect it to be completed?

Mr. HOWARD. In March 1992, NAL entered into an agreement with CAB International of the United Kingdom and the Food and Agriculture Organization (FAO) of the United Nations in which we agreed to strengthen cooperation in the development of a unified world agricultural thesaurus. In addition, NAL, FAO and CAB International are working with the International Development Research Center of Canada to develop an automated system to support the unification efforts.

Our goal is to increase the compatibility and convergence of content, structure, and usage of existing agricultural thesauri to the point of unification.

The first step toward this unification is the development of a classified version of each existing thesaurus based on a common classification scheme. This work is underway, with a scheduled completion date of July 1994. We anticipate that the unification process, including the resolution of differences, will require an additional 2 years.

INFORMATION CENTERS-RESOURCES

MR. PETERSON. Please update the tables that appear on pages 683 and 684 of last year's hearing record showing the resources provided to the Information Centers, to reflect fiscal year 1992 actuals and fiscal year 1993 estimates.

Mr. HOWARD. I will provide the revised tables for the record.

[The information follows:]

RESOURCES PROVIDED TO NAL INFORMATION CENTERS - FY 1992

Information Center	General Purpose	Appropriation	Reimbursement	Total Direct Resources	Related Support[1]	Staff Years
Agricultural Trade & Marketing	Provides information that aids U.S. agribusiness in remaining competitive in the international marketplace.	61,900[2]	-0-	61,900	227,063	1.0
Alternative Farming Systems	Offers ideas to agriculturalists interested in lessening the impact of farming on the environment.	67,870[2]	167,500	235,370	181,150	2.8
Animal Welfare	A focal point for those interested in obtaining information on domestic and laboratory animal welfare.	641,420	-0-	641,420	4,455	4.1
Aquaculture	Assists those interested in aquaculture in establishing profitable operations.	109,150[2]	76,500	185,650	162,080	3.0
Biotechnology	Storehouse for current knowledge on genetic engineering, and other scientific data related to farm animals and plants.	180,246	30,331	210,577	355,649	1.0
Food and Nutrition	Maintains and monitors current data on healthy diet and nutrition for all sectors of U.S. society.	404,932	160,000	564,932	287,166	2.5
Rural	Provides information and referral services to local governments and communities to revitalize rural communities.	293,935	413,200	707,135	267,686	6.0
Technology Transfer	Assists in getting research results into the hands of those who can put it to practical use.	191,567	-0-	191,567	101,882	1.0
Youth	Supports youth development professionals in meeting the needs of America's youth.	-0-	87,747	87,747	115,182	1.0
Water Quality	Monitors and maintains information on farming's effects on U.S. Water supplies.	215,530	-0-	215,530	12,254	1.0
Plant Genome Information Center	To support the information and data management needs for the USDA Plant Genome Research Program.	-0-	1,140,000	1,140,000	18,696	6.4
	TOTAL	2,166,550	2,075,278	4,241,828	1,733,263	29.8

[1]Funding for general NAL activities related to the information center.
[2]Funding redirected to support information center.

RESOURCES PROVIDED TO NAL INFORMATION CENTERS - FY 1993

Information Center	General Purpose	Appropriation	Reimbursement	Total Direct Resources	Related Support[1]	Staff Years
Agricultural Trade & Marketing	Provides information that aids U.S. agribusiness in remaining competitive in the international marketplace.	65,050[2]	-0-	65,050	215,710	1.0
Alternative Farming Systems	Offers ideas to agriculturalists interested in lessening the impact of farming on the environment.	66,600[2]	100,000	166,600	172,093	2.8
Animal Welfare	A focal point for those interested in obtaining information on domestic and laboratory animal welfare.	548,179	-0-	548,179	4,232	3.9
Aquaculture	Assists those interested in aquaculture in establishing profitable operations.	108,235[2]	23,500	131,735	153,976	2.5
Biotechnology	Storehouse for current knowledge on genetic engineering, and other scientific data related to farm animals and plants.	144,338	16,000	160,338	337,867	1.5
Food and Nutrition	Maintains and monitors current data on healthy diet and nutrition for all sectors of U.S. society.	380,609	175,000	555,609	272,808	2.0
Rural	Provides information and referral services to local governments and communities to revitalize rural communities.	252,868	469,856	722,724	254,302	5.4
Technology Transfer	Assists in getting research results into the hands of those who can put it to practical use.	183,113	-0-	183,113	96,788	1.0
Youth	Supports youth development professionals in meeting the needs of America's youth.	-0-	70,000	70,000	109,423	1.0
Water Quality	Monitors and maintains information on farming's effects on U.S. Water supplies.	206,869	-0-	206,869	11,641	1.0
Plant Genome Information Center	To support the information and data management needs for the USDA Plant Genome Research Program.	-0-	1,380,000	1,380,000	17,761	6.4
	TOTAL	1,955,861	2,234,356	4,190,217	1,646,601	28.5

[1]Funding for general NAL activities related to the information center.
[2]Funding redirected to support information center.

INFORMATION CENTERS

Mr. PETERSON. Did you establish any new centers or plan to stop providing services to any existing centers in fiscal year 1993?

Mr. HOWARD. No new information centers were established in fiscal year 1993, nor did any information centers stop providing services.

RURAL INFORMATION CENTER—DHHS AGREEMENT

Mr. PETERSON. You have an agreement with the Department of Health and Human Services to operate the Rural Information Center Health Service for the Department's Office of Rural Health Policy on a reimbursement through fiscal year 1992. You testified last year that you thought this agreement would be extended. Has this been the case?

Mr. HOWARD. Yes, the Office of Rural Health Policy of the Health Resources and Services Administration, U.S. Department of Health and Human Services, extended the agreement with the Rural Information Center of the National Agricultural Library to continue operation of the Rural Information Center Health Service through fiscal year 1997.

Mr. PETERSON. Provide a brief description of the services this Center provides.

Mr. HOWARD. Services of the Rural Information Center and the Rural Information Center Health Service include providing customized information products to specific inquiries, including assistance in economic revitalization issues; local government planning projects; rural health issues; funding sources; and other related issues for the purpose of monitoring the quality of rural life.

Processing a broad array of general and funding information requests on such topics as: successful strategies, models, and case studies of community development projects; small business attraction, retention, and expansion; tourism promotion and development; recycling programs; closures, restructuring and diversification of rural hospitals and clinics; agricultural health and safety; and state initiatives concerning rural health delivery issues.

Referring users to organizations or experts in the field who can provide additional information; performing brief database searches of requested topics on a complimentary basis; furnishing bibliographies and Rural Information Center Publication Series titles; and identifying current USDA and DHHS research and Cooperative Extension Systems programs.

NATIONAL AGRICULTURAL TEXT DIGITIZING PROJECT

Mr. PETERSON. Iowa State University was preparing an evaluation report on the National Agricultural Text Digitizing Project to be released in June or July of 1991. At last year's hearing, Ms. Pisa testified that a draft was in progress with the final report to be available in June 1992. What were the results of this report?

Mr. HOWARD. The final report of the National Agricultural Text Digitizing Project was published by Iowa State University in De-

cember 1992. The primary conclusion of the project was that optical scanning and text digitizing technologies work very effectively in providing information to the agricultural community. The report recommended that NAL establish a National Agricultural Text Digitizing Program. In addition, a number of improvements were recommended, including the hiring of permanent staff and installing system upgrades to facilitate cross platform use of products.

With assistance from the American Society of Agronomy, NAL has produced a CD-ROM containing 16 volumes of the Society's journal. A second CD-ROM disc has been produced on the topic of aquaculture. A third disc is underway in cooperation with Tuskegee University. It will contain selected materials by the famed scientist George Washington Carver.

NATIONAL AGRICULTURAL LIBRARY USAGE INDICATORS

Mr. PETERSON. Please update the table that appears on page 689 of last year's hearing record on usage indications of the National Agricultural Library to include fiscal year 1992 actuals.

Mr. HOWARD. I will provide the table for the record.

[The information follows:]

	1992 actual	1993 est.	1994 est.
Requests filled by NAL	117,680	123,564	129,742
Regional document delivery to USDA	65,433	68,705	72,140
Interlibrary borrowing for USDA	20,169	21,177	22,236
Reference requests	49,251	51,714	54,300
Online and CD-ROM database searches	16,734	17,571	18,450
Current Awareness searches	93,152	93,152	93,152

Note.—The table previously separated reference questions into those for information centers and others. Our statistics are now reported only as total reference requests.

AQUACULTURE REGULATION BOOKLET

Mr. PETERSON. An aquaculture regulation booklet highlighting the roles of FDA, EPA, USDA, and the U.S. Fish and Wildlife Service was expected to be published in July 1992. What is the status of this booklet?

Mr. HOWARD. The booklet, titled *Federal Regulation of Drugs, Biologicals, and Chemicals Used in Aquaculture Production,* was issued by USDA in September 1992. The booklet was developed under the leadership of the Joint Subcommittee on Aquaculture and represents a collaborative effort among NAL, APHIS, CSRS, FDA, EPA, and the Catfish Farmers of America. The booklet is intended as a reference for aquaculture industry leaders, educators, and others involved in the use of animal drugs, feeds, vaccines, herbicides, algicides, and related compounds in aquaculture situations.

The 123-page booklet describes the Federal regulations of FDA, EPA, and APHIS on using compounds in aquaculture production.

AQUACULTURE REGULATION BOOKLET—COSTS

Mr. PETERSON. Printing was to be funded jointly by the Library and FDA. What was the total cost of this booklet? What was your portion of the cost?

Mr. HOWARD. The total cost for printing this booklet was $7,500. The printing was funded by FDA, the USDA Cooperative State Research Service and the Catfish Farmers of America. NAL Aquaculture Information Center staff coordinated the text editing, design, and printing process, but the Library did not pay any portion of the printing costs.

Mr. PETERSON. Two national aquaculture associations, the Catfish Farmers of America and the National Aquaculture Association, have expressed interest in providing financial assistance to help cover additional costs. Has this been the case?

Mr. HOWARD. The Catfish Farmers of America provided NAL with a total of $2,500 to help meet the printing costs of this booklet. The National Aquaculture Association has also expressed interest in supporting aquaculture information products.

Mr. PETERSON. For the record, please submit a copy of this booklet.

Mr. HOWARD. I will be happy to.

[CLERK'S NOTE.—The booklet is too lengthy for reprint. A copy is retained in Committee files.]

NAL EXCHANGE WITH COUNTRIES IN CENTRAL EUROPE

Mr. PETERSON. For the record, describe in further detail the initiative you have underway with regard to exchanging information with countries in Central Europe.

Mr. HOWARD. Over the last 2 years, NAL has been working to develop closer ties to the agricultural libraries of Central Europe for the purpose of strengthening organizational linkages that will lead to improved networking of agricultural information. Two Roundtables have been held: one in Beltsville, Maryland in 1991, and the most recent in October 1992 in Budapest, Hungary. At the Budapest Roundtable, NAL entered into a joint program of cooperation with its counterparts in Albania, the former Czech-Slovak Federal Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, and Slovenia. The agreement outlines areas of interest for cooperatively enhancing access to agricultural information and will serve as the basis from which future collaborative efforts will be negotiated. Areas identified for cooperation include: publications exchange; development of electronic information systems and products on subjects of mutual interest; staff development and exchanges; and strengthening document delivery especially through the use of new technology.

SATELLITE PROJECT WITH MIDDLE TENNESSEE STATE UNIVERSITY

Mr. PETERSON. Both the House and the Senate reports accompanying the 1993 Appropriations Bill urged the Department to give consideration to providing, within available funds, a satellite downlink and fiber optic information link between the Library and the Office of Public Affairs and satellite uplink and downlink capabilities at Middle Tennessee State University. What is the status of this project?

Mr. HOWARD. Funds are not currently available to implement this project.

DOCUMENT DELIVERY SERVICES—INCREASING COSTS

Mr. PETERSON. In your statement, you mentioned the increasing cost to provide document delivery services to a point where you have had to delay programs to meet these costs. Specifically, what other programs have you delayed?

Mr. HOWARD. In order to insure that delivery and other basic services continue, NAL conducted a review of the funding of all program areas with a view towards reducing expenditures to the fullest extent possible. A variety of measures were implemented in addition to reductions in travel, training, and printing expenditures, including: freezing the filling of all vacant positions for a minimum of 6 months; reducing Information Center funds by $50,000; reducing the Library book budget by $150,000; decreasing AGRICOLA database training by 50 percent; reducing the number of bibliographic information products issued by 25 percent; decreasing by a minimum of 10 percent, costs incurred for computer search services; and adjusting the temperature in the NAL building, by 2 degrees, to reduce utility charges.

DOCUMENT DELIVERY SERVICES—COST

Mr. PETERSON. How much did you spend in fiscal year 1992 for document delivery services, and how much do you plan to spend in fiscal year 1993?

Mr. HOWARD. The National Agricultural Library spent $2,025,133 for document delivery services in fiscal year 1992. We estimate that document delivery services will cost $2,200,000 in fiscal year 1993.

DOCUMENT DELIVERY SERVICES—FEES CHARGED

Mr. PETERSON. Are recipients of this information charged a fee of the delivery of the information?

Mr. HOWARD. NAL charges a fee to most categories of non-USDA users for photocopies, copies of microfiche, and copies of microfilm.

Mr. PETERSON. Would it take a change in legislation to charge a fee for these services?

Mr. HOWARD. No. NAL has statutory authority to charge for the sale of copies of bibliographies and photographic reproduction of materials.

Mr. PETERSON. Mr. Skeen.

RURAL ASSISTANCE

Mr. SKEEN. Mr. Howard, I really appreciate your citing the instance of De Baca County where a county agent, through your information, was able to acquire grants from State and Federal agencies for about half a million dollars. That is real country; De Baca County.

Mr. HOWARD. That is what I understand.

Mr. SKEEN. Is this just an isolated case, or have you emphasized working with rural communities?

Mr. HOWARD. We emphasize help to the rural communities. Our program is that we try to encourage the questions to come through the extension agents rather than directly from the farmer. We will take questions from the farmer, but we are trying to see if we can't

work with extension agents in providing both our expertise and the extension agent's expertise.

Mr. SKEEN. But you take them from farmers as well?

Mr. HOWARD. Yes, we do.

Mr. SKEEN. Are you particularly interested in extension services that cover a broader scope? You made improvements in your infrastructure, and Mr. Peterson was referring to some of these.

Are you incorporating these same plans in your requests this year for budget extension?

Mr. HOWARD. These are in our budget request.

Mr. SKEEN. You are still dealing with the same number of problems, but you have made some improvements, have you not?

Mr. HOWARD. That is correct.

Mr. SKEEN. So we will anticipate that you will renew your requests that you made in the past for increases in your funding?

Mr. HOWARD. That is correct.

Mr. PETERSON. Mr. Myers?

Mr. MYERS. No questions.

FACILITY REPAIR

Mr. PETERSON. Just a follow up on one of the questions asked earlier. On facilities repair funding, the Facility Condition study identified approximately $12 million worth of repairs, but didn't you have $900,000 available for facility repairs last year?

Mr. HOWARD. We put $604,000 of the $900,000 mainly for the elevators and book lift—replacement of the elevators and the book lift. And we have—for the first time—handicapped access to the building.

Mr. PETERSON. So have those funds already been expended?

Mr. HOWARD. Yes, and the work is in process.

Mr. PETERSON. I thank you very much.

Mr. SKEEN. Those were modifications that you have already done?

Mr. HOWARD. They are in the process now.

Mr. SKEEN. Are in process?

Mr. HOWARD. The elevator repair people are in our building, as we speak—

Mr. SKEEN. That is what I was referring to earlier. They are in the process.

Mr. MYERS. Did you finally get the roof fixed after all the years?

Mr. HOWARD. We got the roof fixed, but I want you to know that last week—

Mr. MYERS. Why did I bring that up?

Mr. HOWARD [CONTINUING]. —We had another disaster. So I am sure that you will be hearing from us.

Mr. PETERSON. We thank you very much, Mr. Howard and your staff, and, Steve, of course, for being here today.

This concludes the hearing.

National Agricultural Library

Statement of Mr. Joseph H. Howard, Director, National Agricultural Library, before the Subcommittee on Agriculture, Rural Development, Food and Drug Administration, and Related Agencies

Mr. Chairman and members of the Subcommittee, it is a pleasure for me to appear before you today to speak about the National Agricultural Library (NAL) and the work we are doing.

In testifying today I want to emphasize at the outset that the Administration is currently formulating the President's FY 1994 Budget. Accordingly, I am not in a position to provide you with the Administration's position on funding for specific programs or activities. As soon as the President's FY 1994 Budget is released I would be pleased to provide you with the Department's views.

NAL is an agency of the U.S. Department of Agriculture and was established in 1862 under legislation signed by President Abraham Lincoln. In the simplest terms, NAL's role is to gather, maintain, and make accessible the agricultural information and knowledge that is necessary to assure that the United States stays the most productive agricultural nation in the world.

This information is used by many, including the nation's scientists, researchers, university professors and students, government leaders, agribusiness leaders, farmers and consumers.

In their research and decision-making, these people depend on NAL to have the most comprehensive collection of agricultural knowledge available anywhere.

With the Library of Congress and the National Library of Medicine, we are one of three national libraries of the United States. NAL also serves as the departmental library for the U. S. Department of Agriculture, serving USDA employees worldwide.

As Director of the National Agricultural Library, I report to the USDA Assistant Secretary for Science and Education. In my activities as NAL Director, I am supported by associate directors for automation, public services and technical services.

Approximately 200 people are employed at NAL, including librarians and subject specialists, computer specialists, technical information specialists and support staff. The NAL building is located adjacent to the Beltsville Agricultural Research Center in Beltsville, Maryland, where we have been since 1969.

NAL, with a collection of over 2 million volumes, is the largest agricultural library in the world. The size of the NAL collection is perhaps best imagined when one considers that we have 48 miles of book shelves. These shelves are chock-full of agricultural information, dating as far back as the seventeenth century. The collection includes items in 75 different foreign languages.

NAL's collection is not only books and periodicals. It also includes photographs, slides, films, videotapes, theses, patents, software, optical discs and artifacts. Since the collection grows at the rate of approximately 25,000 items a year, we are fast approaching the point where we will run out of shelf space. We are currently striving to develop plans to deal with this problem, which I will address briefly later in my remarks.

Although NAL does not have field offices, it does serve as the coordinator and primary resource for a nationwide network of state land-grant university libraries and field libraries of various USDA agencies. NAL, together with these other libraries, operates a regional document delivery service which provides access to agricultural and scientific documents to USDA researchers across the country.

NAL and land-grant libraries also collaborate on programs to improve access to and maintenance of the nation's agricultural knowledge. In recent years, this has been done more and more frequently through the application of electronic technology such as text digitizing, laser disc and CD-ROM. Again, later in my remarks I'll explain some of these efforts.

AGRICOLA, which stands for AGRICultural OnLine Access, is NAL's bibliographic database providing quick access to the NAL collection. AGRICOLA contains 3 million citations to agricultural literature, and is known by users of agricultural information worldwide. AGRICOLA is widely available online or on compact disc.

Another important part of NAL activities is our group of information centers. To better meet the agricultural information needs of the nation, NAL has established and maintains specialized information centers which draw upon NAL resources in 11 areas of particular concern to the agricultural community. These centers provide in-depth services ranging from responding to reference requests and developing publications, to establishing dissemination networks.

Subjects covered by these information centers are agricultural trade and marketing, alternative farming systems, animal welfare, aquaculture, biotechnology, food and nutrition, plant genome, rural development, technology transfer, water quality and youth development.

Topics covered by NAL's information centers respond to research, business and consumer interests. NAL's Rural Information Center, for example, is involved very directly in the revitalization of rural America at the grass roots level. I'd like to explain what I mean when I say that NAL serves rural communities directly.

A county extension agent in New Mexico came to NAL for assistance when he discovered that a 36 year old x-ray machine at De Baca General Hospital was too outmoded to produce legible film. Using information about grant-seeking strategies and application procedures identified by NAL's Rural Information Center, the extension agent was successful in obtaining a half a million dollars in state and Federal grants to update the hospital's basic surgical equipment. Equipped with a new x-ray machine, fetal heart monitor, heart

defibrillator, and other surgical equipment, a greatly improved health care capability was brought to an isolated rural community.

Another NAL success story involves enhancing the economic base of a rural area. A regional development organization in the Southwest sought assistance from the NAL Rural Information Center in identifying potential uses of zeolite. Using literature searches and articles furnished by NAL staff, six commercial new markets for this product were identified. Once the development organization determined that a local mining company could indeed be profitable mining large quantities of zeolite, 12 local employees of this company retained their jobs. In fact, the project became so successful that other institutions began further research in the area of zeolite use, which may generate new jobs in rural areas.

I think that most would agree that agriculture holds the key to the nation's continued prosperity. I'd like to take that a step further and state that the hundreds of years of agricultural information gathered and maintained by NAL holds the key to the continued prosperity of U.S. agriculture.

To mention just a few examples of why that is...

- this information has helped in giving the United States the most nutritious and least expensive food supply in the world...

- it enables us to offer technical assistance and build goodwill throughout the world by aiding in the production of enough food and fiber to provide food-aid to hundreds of developing countries...

- it helps in identifying agricultural export markets for U.S. goods, which in turn, creates millions of jobs in the United States...

- it is a key to developing new strains of crops and improved breeds of livestock that are more resistant to disease, cheaper to produce and, in general, superior to existing crops and livestock.

Most recently, USDA was faced with a situation which poignantly illustrates the importance of the information maintained and made available by the Library. Of course, I am referring to the tragic outbreak of food poisoning caused by the E. coli bacteria in the Northwest. This resulted in thousands of requests for information from the NAL collection.

NAL staff were able to respond quickly to these requests through its AGRICOLA database. Within minutes, NAL staff were able to provide a thorough listing of E. coli bacteria literature and copies of listed articles to USDA officials. NAL followed up on this activity by producing a bibliography on E. coli bacteria and making it available, free of charge, nationwide.

NAL's acquisition of and rapid access to this and all other agricultural research serves to aid scientists to respond to these and other important national needs. NAL routinely responds to such needs, not only from USDA, but also from throughout the nation's agricultural community. This type of service is the backbone of our operations.

NAL is making optimum use of its 1993 appropriation, but with the cost for journal subscriptions increasing at the rate of 15 percent annually and the cost of other library materials increasing at the rate of approximately 20 percent annually, we are experiencing a significant drop in our ability to acquire scientific and technical literature. Moreover, the cost of providing document delivery services has escalated in the last several years to the point where we had to curtail other programs to meet these costs.

However, NAL continues to provide service to its fullest capability and has made significant inroads into the use of new technologies in information management.

In 1993, for example, a key focus at NAL has been establishing the National Agricultural Text Digitizing Program (NATDP) as a fully "operational" program. The text digitizing program is just one example of many, illustrating how NAL is shaping the latest in electronic information management technology so that the library can better serve the nation.

The National Agricultural Text Digitizing Program enables NAL and land-grant university libraries to work together in producing and distributing to libraries nationwide whole sections of the NAL collection on CD-ROM. The program began in 1986 as an effort by NAL and the land-grant libraries to examine and develop ways that the rapid advances in electronic information management could be applied to increasing access to agricultural information. Under NAL's leadership, the program has expanded from 2 libraries to 46 libraries. CD-ROM products have been developed covering aquaculture, international agricultural research, Agent Orange, acid rain, the journals of the American Society of Agronomy and selected papers of George Washington Carver.

Seizing the CD-ROM technology, NAL, in related projects, has developed and distributed other discs covering the subjects of food irradiation and ornamental horticulture. Working with the USDA's Extension Service, NAL also developed a disc of general agricultural information for use by county extension agents in responding to the millions of calls for agricultural information the agents receive each year.

In addition to maximizing the use of the comprehensive collection of agricultural knowledge at NAL, CD-ROMs and other types of electronic information management technologies hold great promise for NAL as we wrestle with the insidious problem of preserving large portions of the collection.

Preservation of materials is an area of huge concern to the world's libraries. Because of the acid contained in much of the paper on which old books and documents were printed, the books and documents are literally turning to dust. A preservation study of the NAL collection conducted in 1989 showed that 50 percent of the monographs and serials are disintegrating and more than one-fourth of the volumes are brittle and can barely be used.

NAL sees the issue of preservation of the nation's agricultural literature as a key focus for the library for the foreseeable future. Meeting this threat to the nation's agricultural information, while trying to maintain the level of service we provide to our traditional users, will be a challenge that we will be addressing.

The problem of preserving the collection may be compounded by something I mentioned earlier in my remarks. And that is that NAL is running out of space to store agricultural materials. Miniaturizing some of the material in electronic form holds the greatest promise in dealing with this lack of space and could possibly be used to deal with the library's preservation problems also.

Finally, because I know my time is short, I'll mention just one other initiative which we are anxious to continue. This is NAL's new-found cooperation with the agricultural libraries of Central European countries.

Following the break-up of the Soviet Union, NAL began contacting several of the newly reorganized countries in Central Europe with an eye toward improving the NAL collection and developing goodwill and cooperation through an exchange of library knowledge and agricultural materials. Our offers of cooperation were greeted with much enthusiasm.

Through two "roundtable" discussions and through exchanges of materials, NAL is improving global access to agricultural information.

All who are participating in this effort stand to benefit and NAL will continue to focus on this activity in hopes of expanding its scope to other countries. An exchange of agricultural information between NAL and the countries of the world can only serve to improve all systems of agriculture.

I'd like to end by saying that with the information maintained and provided by the National Agricultural Library, the citizens of this nation can be assured that access to agricultural information found at NAL will continue to assure that the United States will remain in the forefront of world agricultural affairs. I think that our track record at NAL shows how much we can accomplish.

Thank you. I would be happy to respond to any questions.

NATIONAL AGRICULTURAL LIBRARY

Purpose Statement

The National Agricultural Library (NAL) had its mission outlined by the Organic Act of 1862, establishing the Department of Agriculture. The act, as amended, sets forth a mission, "to acquire and to diffuse among the people of the United States useful information on subjects connected with agriculture, rural development, aquaculture and human nutrition, in the most comprehensive and general sense of the word," and placed upon the Secretary the responsibility to "Procure and preserve all information concerning agriculture, rural development, aquaculture, and human nutrition, which he can obtain by means of books."

NAL serves as the Nation's chief agricultural information resource. It provides agricultural information products and services through traditional library functions and through modern electronic dissemination to agencies of the USDA, public and private organizations, and individuals. NAL coordinates a national network of public and private libraries consisting of the land-grant colleges and universities, other state supported colleges and universities with agriculturally-related programs, other public organizations, industry, and other private sector organizations. The NAL provides a leadership role in U.S. participation in international agricultural library and information systems and in efforts to promote worldwide availability of agricultural information.

NAL has as its ultimate purpose facilitating access to and use of information about agriculture and related sciences by all those who need the information. In addition to providing traditional library services such as bibliographies, reference services and document delivery to agricultural scientists and researchers, NAL is expanding its role and serving a wider audience by using modern information dissemination technology to its fullest. The Library concentrates its thrust towards the agricultural community, which includes Federal, State, and private researchers, administrators, agricultural extension and education personnel, the farmer, the small businessman, public groups at all levels, and the general public.

With approximately 2.1 million volumes of printed material on agriculture and supporting scientific disciplines, NAL has one of the largest collections of its kind in the world. Primarily current, but also historical information is collected and organized for effective utilization by a wide range of users, and is cataloged or indexed in AGRICOLA, the NAL database of 2.9 million citations to agricultural publications. NAL also provides extensive input of U.S. publication records to AGRIS, the cooperative agricultural database of the Food and Agricultural Organization of the United Nations.

The basic operations of NAL are located in the NAL Building at Beltsville, Maryland. Specialized services are provided from a reference center in Washington, D.C. Service is provided from both these locations as well as 18 USDA field libraries and 38 smaller USDA centers containing a total of approximately a quarter of a million volumes.

As of September 30, 1992, NAL employment was 203 permanent full time and 33 other than full time employees. With the exception of six employees stationed in Washington, D.C., all are located in Beltsville, Maryland.

NATIONAL AGRICULTURAL LIBRARY
Available Funds and Staff-Years
1992 Actual Estimated, 1993 and 1994

	1992 Actual		1993 Estimated		1994 Estimated	
	Amount	Staff Years	Amount	Staff Years	Amount	Staff Years
National Agricultural Library	$17,715,000	198	$17,715,000	191	$17,915,000	191
Allocations from:						
Hazardous Waste Management...............	24,135	---	---	---	---	---
Obligations under other USDA appropriation:						
Agricultural Marketing Service:						
Space Costs............	14,719	---	14,719	---	14,700	---
Postage................	1,950	---	2,000	---	2,000	---
Current Awareness Literature Service...	3,318	---	4,061	---	4,000	---
Dun & Bradstreet.......	---	---	208	---	208	---
Agricultural Research Service						
Plant Genome Data & Information Center...	1,140,000	5	1,100,000	6	1,100,000	6
Computer Room Support..	131,788	---	131,788	---	131,000	---
Subscriptions Costs....	8,197	---	10,823	---	11,000	---
Evaluation Study-Tech Transfer.............	47,000	---	---	---	---	---
Evaluation Study-Aquaculture..........	45,000	---	---	---	---	---
Evaluation Study Networking Info. Through Image Transfer............	37,000	---	---	---	---	---
Current Awareness Literature Service...	610,436	5	610,436	5	610,000	5
Space Costs............	47,764	---	---	---	---	---
Postage................	2,333	---	---	---	---	---
Aquaculture-Guide to Federal Gov't. Prog..	1,000	---	---	---	---	---
Global Change Info. Package-Printing.....	65,000	---	---	---	---	---
Translation-Russian....	6,500	---	---	---	---	---
Document Delivery......	15,000	---	---	---	---	---
Animal & Plant Health Inspection Service:						
Current Awareness Literature Service...	32,336	---	33,703	---	33,000	---
Biotechnology-Cataloging Material..	14,331	---	---	---	---	---
Cooperative State Research Service:						
Current Awareness Literature Service...	---	---	1,613	---	1,600	---
Computer Room Support..	38,813	---	38,813	---	38,000	---
Support for Aquaculture Information Center...	19,000	1	18,000	1	18,000	1
Postage & Mail Service.	5,500	---	3,905	---	3,900	---
Space..................	20,499	---	20,499	---	20,500	---

NATIONAL AGRICULTURAL LIBRARY
Available Funds and Staff-Years
1992 Actual Estimated, 1993 and 1994

	1992 Actual		1993 Estimated		1994 Estimated	
	Amount	Staff Years	Amount	Staff Years	Amount	Staff Years
Cooperative State Research (cont.):						
National Biological Impact Assessment Program..............	16,000	---	16,000	---	16,000	---
Alternative Farming Information Center...	167,500	2	100,000	2	100,000	2
Extension Service:						
Current Awareness Literature Service...	14,616	---	14,616	---	14,700	---
Youth 4-H Info. Ctr....	87,747	1	100,000	1	100,000	1
Aquaculture Support....	3,500	---	3,500	---	3,500	---
Farmer's Home Admin:						
Rural Information Support................	13,200	---	52,800	---	52,000	---
Food and Nutrition Service:						
Lending Service........	125,000	---	110,000	---	100,000	---
Forest Service:						
Current Awareness Literature Service...	10,502	---	11,900	---	11,500	---
Indexing Service......	45,465	1	45,465	1	51,300	1
Food Safety & Inspection Service:						
Current Awareness Literature Service...	7,835	---	9,645	---	10,000	---
National Exchange for Food Labeling........	35,000	---	---	---	---	---
Human Nutrition Information Service:						
Current Awareness Literature Service...	8,787	---	9,784	---	9,800	---
National Finance Center:						
Dun & Bradstreet.......	1,686	---	2,594	---	2,500	---
Office of the Inspector General:						
Dun & Bradstreet.......	---	---	2,108	---	2,000	---
Soil Conservation Service:						
Current Awareness Literature Service...	9,875	---	14,363	---	14,500	---
Miscellaneous Activities...	9,828	---	433,657	---	341,292	---
Total Other USDA Appropriations.....	2,864,025	15	2,917,000	16	2,817,000	16
Total Agricultural Appropriations.....	20,603,160	213	20,632,000	207	20,732,000	207

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NATIONAL AGRICULTURAL LIBRARY
Available Funds and Staff-Years
1992 Actual Estimated, 1993 and 1994

	1992 Actual		1993 Estimated		1994 Estimated	
	Amount	Staff Years	Amount	Staff Years	Amount	Staff Years
Other Federal Funds:						
Department of Commerce, NTIS Sale of Photocopies......	28,000	---	28,000	---	28,000	---
Environomental Protection Agency Bibliographies.........	50,000	1	---	---	---	---
National Oceanic and Atomospheric Administration: Aquaculture..........	4,000	---	5,000	---	5,000	---
Food and Drug Administration: Aquaculture Support..	3,000	---	---	---	---	---
Health and Human Services: Rural Information Health Service................	400,000	2	400,000	2	400,000	2
National Exchange for Food Labeling.........	55,125	---	---	---	---	---
Fish and Wildlife: Aquacultural Suppport-Printing...........	1,000	---	---	---	---	---
Total, Other Federal Funds	541,125	3	433,000	2	433,000	2
Non-Federal Funds:						
University of Mississippi: Food Service Education...	45,000	---	45,000	---	45,000	---
Miscellaneous Contributed Funds..................	10,000	---	35,000	---	35,000	---
Total, Non-Federal Funds	55,000	---	80,000	---	80,000	---
Total, National Agricultural Library	21,199,285	216	21,145,000	209	21,245,000	209

UNITED STATES DEPARTMENT OF AGRICULTURE

NATIONAL AGRICULTURAL LIBRARY

PERMANENT POSITIONS BY GRADE AND STAFF-YEAR SUMMARY

1992 and Estimated 1993 and 1994

GRADE	1992	1993	1994
	HEADQUARTERS	HEADQUARTERS	HEADQUARTERS
ES-5	1	1	1
GS/GM-15	3	2	2
GS/GM-14	9	9	9
GS/GM-13	26	23	23
GS-12	56	54	53
GS-11	31	26	25
GS-9	3	2	2
GS-8	3	3	3
GS-7	39	35	34
GS-6	33	31	31
GS-5	13	10	10
GS-4	3	3	2
GS-3	0	0	0
Total, Permanent Positions	220	199	195
Unfilled Positions, End of Year	-17	-6	-6
Total Permanent Employees, End of Year	203	193	189
Staff-Years: Ceiling	216	209	209

NATIONAL AGRICULTURAL LIBRARY

CLASSIFICATION BY OBJECTS

1992 and Estimated 1993 and 1994

		1992	1993	1994
Personnel Compensation				
Headquarters............		$7,400,638	$7,656,000	$6,122,185
11	Total Personnel Compensation.....	7,417,000	7,656,000	7,803,000
12	Personnel Benefits	1,376,269	1,346,000	1,400,000
13	Benefits for Former Personnel........	—	—	—
Total Pers. Comp. & Benefits..............		8,793,000	9,002,000	9,203,000
Other Objects:				
21	Travel.............	153,000	211,000	150,000
22	Transportation of Things...........	84,000	35,000	50,000
23	Communications, Utilities and Other Rent.............	962,000	975,000	975,000
24	Printing and Reproduction.....	219,000	850,000	200,000
25	Other Services.....	3,464,000	3,182,000	3,535,000
26	Supplies and Materials........	2,476,000	2,500,000	2,820,000
31	Equipment..........	775,000	656,000	900,000
41	Grants.............	784,000	439,000	182,000
Total Other Objects		8,917,000	8,848,000	8,812,000
Total Direct Obligations		17,710,000	17,850,000	18,015,000
Position Data:				
	Average Salary, ES Positions	$107,714	$111,212	$115,000
	Average Salary, GS/GM Positions	$39,780	$41,252	$42,722
	Average Grade GS/GM Positions	8.9	8.9	8.9

NATIONAL AGRICULTURAL LIBRARY

The estimates include appropriation language for this item as follows (new language underscored; deleted matter enclosed in brackets):

National Agricultural Library

For necessary expenses of the National Agricultural Library [$17,715,000] $17,915,000: Provided, That this appropriation shall be available for employment pursuant to the second sentence of section 706 (a) of the Organic Act of 1944 (7 U.S.C. 2225), and not to exceed $35,000 shall be available for employment under 5 U.S.C. 3109: Provided further, That not to exceed $900,000 shall be available pursuant to 7 U.S.C. 2250 for the alteration and repair of buildings and improvements [: Provided further, That $462,000 shall be available for a grant pursuant to section 1472 of the National Agricultural Research, Extension, and Teaching Policy Act of 1977 (7 U.S.C. 3318), in addition to other funds available in this appropriation for grants under this section].

The change deletes language providing funds for a grant under section 1472 which in FY 1993 was made to the Leflar School of Law, University of Arkansas, Fayetteville, Arkansas.

NATIONAL AGRICULTURAL LIBRARY

Appropriation Act, 1993...$17,715,000
Budget Estimate, 1994...17,915,000
Increase in Appropriation...+200,000

SUMMARY OF INCREASES AND DECREASES
(On basis of appropriation)

Item of Change	1993 Estimate	Pay Cost	Other Changes	1994 Estimate
Leflar School of Law......	$462,000	-0-	-$462,000	-0-
Journal Subscription and Document Delivery.......	-0-	-0-	+462,000	$462,000
All Other.................	17,253,000	+$201,000	-1,000	17,453,000
Total Available	17,715,000	+201,000	-1,000	17,915,000

PROJECT STATEMENT
(On basis of adjusted appropriated)

	1992 Actual		1993 Estimated			1994 Estimated	
		Staff Years	Amount	Staff Years	Increase or Decrease	Amount	Staff Years
1) Agricultural Library Services for Research & Education....	$16,747,922	198	$16,815,000	191	(1) +$200,000	$17,015,000	191
2) Repair & Maintenance of Facilities..	900,000	---	900,000	---	-0-	900,000	---
Unobligated Balance...........	67,078	---	---	---	---	---	---
Total Available or Estimate..........	$17,715,000	198	$17,715,000	191	+$200,000	$17,915,000	191
Total, Appropriation.....	$17,715,000	198					

National Agricultural Library

Explanation of Programs

The basic function of the National Agricultural Library (NAL) is to identify, acquire, disseminate, and deliver pertinent food and agriculture information to all scientists, researchers, administrators, and others working in agricultural fields in both the government and private sectors. To meet user needs, NAL is working with libraries at land-grant universities and other institutions to develop a network to enhance access to information. NAL also maintains an extensive collection of agricultural publications and provides access to these publications through AGRICOLA, its master bibliographic database. NAL also provides current awareness and retrospective searches on worldwide agricultural literature through other computer-based systems of interest to agricultural scientists and educators.

New technologies and systems of networking that contribute to making it possible for the user to have faster, more sophisticated, and more cost effective access to information is at the forefront of NAL's initiatives.

One essential NAL program involves advanced information technologies. NAL has intensified its efforts to enhance and expand its information-providing capabilities by testing the exciting possibilities of the new technology, including computer-based video technology, both often coupled with recently developed optical scanning and developing laser technology, and artificial intelligence software. The NAL staff strives to identify and evaluate these advanced technologies to determine their potential for improving agricultural information access and use. As these advanced technologies are applied to specific projects, NAL works to transfer their use to other agricultural organizations, which could benefit from their adoption. Such technologies have great potential for making information more widely available in a more timely way and in greater depth than ever before. By using advanced information technology, NAL will be better able to promote the organization and availability of agricultural information to the national and international agricultural communities.

In an effort to improve services in particular subject areas, NAL has established specialized information centers to provide enhanced services to current clientele as well as to develop new service relationships with the public and private sectors. The purpose of the centers is to focus activities in the areas of great interest to the Department of Agriculture, the agricultural community throughout the Nation, and the public. NAL is able to take a proactive approach that involves a heavy emphasis on outreach and networking activities. In addition, information center staff concentrate their efforts on strengthening the NAL collection and developing information products. Information centers have a diverse audience including researchers, administrators, educators, consumers, and the private sector to a greater degree. Currently, NAL has information centers on Agricultural Trade and Marketing; Alternative Farming Systems (Low Input/Sustainable Agriculture); Animal Welfare; Aquaculture; Biotechnology; Food and Nutrition; Horticulture; Rural Development; Youth Development; Technology Transfer; and Water Quality.

NAL serves a dual role as the primary literature source for the American agricultural community and as a national authority among libraries and information centers here and abroad. NAL also is cooperating with the National Library of Medicine on sharing collection responsibilities for veterinary science, human nutrition, and biotechnology.

National Agricultural Library

Justification of Increases and Decreases

(1) A net increase of $200,000 for library services, consisting of the following:

(a) A decrease of $462,000 for the Leflar School of Law, University of Arkansas ($462,000 available in FY 1993).

This decrease reflects the discontinuation of the funding of a grant to the Agricultural Law Library of the Leflar School at the University of Arkansas.

(b) An increase of $462,000 for journal subscriptions and document delivery services ($4,100,905 available in FY 1993).

Need for Change: - The escalation of costs for library materials, services and equipment continues to erode NAL's capability to provide basic agricultural information services.

Approximately 80 percent of the NAL library materials budget is used to obtain subscriptions to agricultural and scientific journals. NAL users rely on these journal publications to obtain the results of the most current scientific investigations. The cost for journal subscriptions is increasing at the rate of 15 percent annually. Industry statistics over the last three years indicate the following trends in journal subscription prices for the subjects considered core to NAL user needs:

Aquaculture	+122 percent
Veterinary medicine	+ 60 percent
Animal Science	+ 57 percent
Botany	+ 37 percent
Agriculture	+ 35 percent
Agronomy	+ 19 percent
Forestry	+ 16 percent

In addition to reinstating lapsed subscriptions, funds are needed to maintain current subscriptions; obtain subscriptions to new electronic journals and software products; and acquire new titles on subjects directly related to the research efforts of the USDA scientific community.

Further, the cost of providing document delivery services, including the regional document delivery system and interlibrary loan activities increases significantly each year. In FY 1994, the cost of providing these services will increase by approximately 15.6 percent.

Nature of Change: - The additional $462,000 will be used for the purchase of journal subscriptions and books and for the provision ofdocument delivery services.

(c) An increase of $241,000 which reflects a 2.7 percent increase in non-salary costs.

(d) An increase of $201,000 which reflects the annualization of the fiscal year 1993 pay raise.

(e) A decrease of $239,000 for administrative efficiency.

Need for Change: - To promote the efficient use of resources for administrative purposes, in keeping with the President's Executive Order, total USDA baseline outlays for these activities will be reduced by 3 percent in FY 1994, 6 percent in FY 1995, 9 percent in FY 1996 and 14 percent in FY 1997.

Nature of Change: - NAL will save $65,000 by abolishing a vacant budget officer position and reassigning this responsibility to an existing position. The additional required savings will be realized through a combination of measures, including: careful monitoring of supply and furniture purchases; decreasing the amount available for consulting services; adjusting the temperature and accelerating the installation of energy saving light fixtures in the NAL building to reduce utility costs; and reducing travel by 10 percent of the total amount available in FY 1993.

(f) A decrease of $3,000 for FTS 2000 funding.

This decrease reflects lower long distance telecommunications prices due to price redeterminations in the FTS 2000 contracts.

NATIONAL AGRICULTURAL LIBRARY
GEOGRAPHIC BREAKDOWN OF OBLIGATIONS AND STAFF-YEARS
1992 And Estimated 1993 and 1994

	1992		1993		1994	
	Amount	Staff Years	Amount	Staff Years	Amount	Staff Years
District of Columbia	$225,529	6	$266,000	6	$274,000	6
Maryland..............	17,422,393	192	17,449,000	185	17,641,000	185
Subtotal, Available or Estimate..............	17,647,922	198	17,715.000	191	17,915,000	191
Unobligated Balance	67.078	---	---	---	---	---
Total, Available for Estimate..........	17,715,000	198	17.715.000	191	17,915,000	191

NATIONAL AGRICULTURAL LIBRARY

Status of Program

The National Agricultural Library (NAL) is one of the most heavily used and largest agricultural libraries and information services in the world, serving as the national resource for the collection and dissemination of information on all aspects of agriculture. As one of three national libraries, together with the Library of Congress and the National Library of Medicine, NAL serves not only as USDA's departmental library, but also fulfills national and international responsibilities. It acts as the coordinator and primary resource for a national network of State land-grant university libraries working together to deliver information to all sectors of the population. As the designated U.S. center for the international agricultural information system, NAL is actively involved in enhancing global access to agricultural data.

The basic services provided by the Library reflect the national and international nature of its mission. NAL lends books and provides photocopies of documents, responding to more than 170,000 requests for such materials each year. AGRICOLA, the Library's master bibliographic database, consists of more than 2.9 million computerized citations to books and articles on worldwide agriculture. The database tapes are marketed through the National Technical Information Service (NTIS), U.S. Department of Commerce, and can be accessed nationally and internationally through commercial vendors. The NAL collection, on which AGRICOLA is based, contains books, journals, maps, audiovisuals, and microcomputer software obtained through purchase, gift, and exchange arrangements.

NAL's general reference units and subject-oriented information centers provide comprehensive reference and referral information services to support USDA policy makers, research and administrative scientists, and other USDA personnel. Reference services are also extended to other Federal and State agencies, Congressional staff, and industry as well as to the general public when local and regional resources have been exhausted. New Congressionally-mandated information centers have been established in recent years to meet the growing demand for information in topics of vital interest to USDA such as aquaculture, water quality, and rural development.

Current Activities

Networking. NAL conducts a national education and training program designed to inform actual and potential users about NAL operations, resources, and services. NAL offers workshops and demonstrations in cooperation with agricultural institutions, and professional and trade organizations across the country. The emphasis in this program is on the use of online bibliographic files and other computer services. Briefings, tours, and exhibits are provided for domestic and foreign visitors to NAL.

NAL works closely with library directors at 1890 land-grant and 1862 land-grant universities to enhance access to agricultural information in these universities. Through its role in the Department's initiative to establish centers of excellence in these universities, NAL is working to ensure the development of library collections and services that will support the mission of each center.

In response to the increasing demand for technical information on agriculture, NAL continues to expand its collection development and information access programs through coordination of holdings with and among land-grant universities and through international exchange programs with foreign governments, universities, and research centers. It initiates and implements cooperative indexing and cataloging projects with public and private institutions and strengthens agricultural library and information activities nationally through development and adoption of standardized formats and processing procedures essential for national networking.

NAL is developing network plans systematically, by seizing opportunities for specific cooperative projects which can eventually serve as the framework for the broad network. One of these cooperative activities is the Aquaculture Library Network, created under the leadership of NAL to support four regional aquaculture centers. The network members seek to provide an information linkage between the extension services and research development which will take place within each region. In another cooperative activity, coordinating the development of conspectuses and collection coverage in the field of agriculture, NAL has negotiated agreements with the National Library of Medicine in the fields of veterinary science, nutrition, biotechnology and animal welfare. These agreements assure complete coverage in these fields while avoiding unnecessary duplication of resources.

Several new cooperative projects are underway utilizing new information technology. NAL continues to develop ISIS, the Library's integrated library system. Innovative approaches to expanding the benefits to other USDA information providers are being explored. A project is underway to provide online dial-up access to the system at NAL for the Agricultural Research Service (ARS) regional libraries and other research sites. Another related project allows ARS libraries to include their holdings in ISIS. NAL and the Extension Service have completed work on a CD-ROM product containing over 50,000 pages of agricultural information aimed at the state extension worker. A pilot project has been completed between the Economic Research Service (ERS) and NAL in which a CD-ROM simulation product containing ERS publications was developed. NAL and the state extension services in Florida and Michigan are currently working on the development of a multi-media CD-ROM on ornamental horticulture.

Information Centers. Eleven specialized information centers take a proactive approach to providing a unique information service to members of the United States and international agricultural community. Subject areas covered by these information centers include: agricultural trade and marketing, alternative farming systems (sustainable agriculture), animal welfare, aquaculture, biotechnology, food and nutrition, plant genome, rural development, technology transfer, water quality and youth development.

Identifying potential and existing audiences, developing products and services to meet their information needs, and providing frequent communication utilizing optimal information technology are the objectives of each information center. Emphasis is placed on outreach and liaison activities with all the various clientele groups interested in a specific subject area. Collaborative efforts with other Federal agencies both within and outside USDA have allowed NAL to greatly expand existing networks to include rural health practitioners, rural elected public officials, school food service managers, nutritionists in the Women, Infants, and Children (WIC) Supplementary Feeding Program, and educators.

State Agricultural Publications. NAL and land-grant libraries work cooperatively to provide improved coverage of state agricultural publications. Through their combined efforts, the national and state libraries can collect, process, and provide document delivery services for state experiment station and extension service publications. Land-grant library directors have designated contact persons for coordination of activities with NAL staff. In a few cases, it was established that state libraries or university libraries other than land-grant libraries had archival responsibility for state agricultural publications. NAL also works with these institutions to obtain a comprehensive collection of state publications. Land-grant libraries are providing NAL with information for the direct acquisition and cataloging of an increasing number of state agricultural publications for inclusion in AGRICOLA.

International Activities. NAL engages in a wide range of international activities relating to the worldwide collection and dissemination of information on agriculture and related subjects. Its AGRICOLA database is accessible online worldwide, and is now available as a CD-ROM product from commercial vendors. The

Library is the designated U.S. center for AGRIS, the international agricultural information system of the United Nations Food and Agricultural Organization (FAO) and provides essential support to the FAO's Aquatic Science and Fisheries Information System (ASFIS). Under an arrangement with the CAB International, NAL is augmenting and updating the CAB Thesaurus, an agricultural vocabulary. A related project to provide more comprehensive access to international agricultural information through an enhanced thesaurus system is being coordinated by NAL in conjunction with CAB International and FAO. NAL also encourages countries to index more of the publications originating in their own country as NAL concentrates its resources on indexing U.S. literature. Jointly with CAB International, NAL has produced an International Union List of Agricultural Serials which was published 1990. The CD-ROM version of the World List of Agricultural Serials, from which the International Union List was extracted, was made available by SilverPlatter International in January 1992. This database contains citations to more than 56,000 retrospective and current serial titles with annotations indicating whether the title is indexed in any of the three major agricultural databases: AGRICOLA, CAB Abstracts, and AGRIS. Steps are now being taken to determine the feasibility of creating a union list for key agricultural libraries worldwide based on this database.

Following the intense political and economic evolution in the nations of central and eastern Europe, NAL hosted the first U.S./Central European Agricultural Library Roundtable to explore possibilities for cooperation in the exchange of agricultural information. NAL and its counterparts in Bulgaria, Czech-Slovak Federal Republic, Hungary, Poland, Romania, and Yugoslavia met in Beltsville and agreed to support a joint program of cooperation to enhance access to agricultural information by strengthening existing avenues and expanding the use of technologies. With NAL's encouragement, including greater personal and institutional contacts, the exchange of agricultural information with both the People's Republic of China and the Newly Independent States has expanded significantly.

Information Centers at NAL provide new forums for international networking and information exchange. The databases being developed by the Plant Genome Data and Information Center will be international in scope. Efforts are underway to develop links with similar database efforts in Japan. The Aquaculture Information Center serves as the central information exchange point for Federal agencies and research institutions in Japan and the People's Republic of China.

NAL has worked with the USDA Office of Public Affairs and several other USDA agencies to place the centralized USDA files of current and historic photographs as well as photo collections of other USDA agencies on optical disk. The project increases access to the collections to a wide audience and improves productivity in the management of the collections. Planning for expansion of this project to include more images is underway.

The Agricultural Library Forum (ALF), an electronic bulletin board system, provides remote, around-the-clock access to information sources, services, programs, activities, and assistance pertinent to agricultural interests. Through the bulletin board, special conferences have been set up allowing participants to communicate with each other electronically. These conferences constitute special interest groups for focused discussion of topics including biotechnology, groundwater, and alternative agricultural opportunities. Updated versions of text files, lists, and programs heretofore available only in printed form, are now readily available nationwide and even worldwide at electronic speeds. ALF provides timely and remote access for users nationwide to a broad range of information at minimum cost and high flexibility and effectiveness.

The acquisition of agricultural materials from 150 countries and in more than 30 languages continues to be a major activity in carrying out the mission of NAL. Other primary activities for Fiscal Years 1992, 1993, and 1994 are as follows:

	Estimated Productivity		
Types of Activities	Actual FY 1992	Estimate FY 1993	Estimate FY 1994
Serial Issues Added	136,646	137,000	137,500
Number of Titles Cataloged	22,785	23,000	23,250
Articles Indexed	79,398	79,000	80,000
Pages Preserved	3,300,000	3,300,000	3,300,000
Document Requests Filled	117,680	123,564	129,742
Reference Inquiries Answered	49,493	50,200	50,200
Automated Searches Conducted	37,836	38,000	38,500
Current Awareness (CALS) Searches	98,742	104,000	105,000
Current Awareness (CALS) Profiles by all databases	22,422	24,000	25,000

A major function of the bibliographic program is to organize library materials for use by researchers, and the announcement of newly-published research to the agricultural community. This includes cataloging books and journals acquired for the collection, and indexing journal articles, conference proceedings, and reports selected for their importance to agricultural research and education. Resources of the collection are made available through both direct and interlibrary loan of books and photocopies of journal articles. Requests for documents from USDA field employees are handled locally in 37 States and Puerto Rico in cooperation with land-grant university libraries whenever possible, with the NAL serving as a backup for document delivery.

NAL must ensure that scientists, administrators, educators and other users continue to have access to all useful information in the collection, including that contained in deteriorating materials. To accomplish this, a preservation program is required. This includes the transference of information to other formats, binding unbound materials, restoring important documents and making in-house minor repairs when technically feasible. The staff has completed a report of a comprehensive preservation planning program study investigating all aspects of preservation activity at NAL from physical and environmental conditions of the collection to disaster control, staff and user education, and inter-institutional cooperation. The ultimate purpose of the study is to develop and implement an effective program for ensuring the availability of important agricultural information for future generations of researchers and other users.

The first phase of the National Agricultural Text Digitizing Project (NATDP) has been completed. This is a cooperative project undertaken by NAL and 44 land-grant university libraries to evaluate new methods of capturing and disseminating full text information on CD-ROMs. Using a system which digitizes both the page image and the text on the page, users are able to search the text of documents by any word or combinations of words. Four CD-ROM products have been distributed to project participants for their evaluation, covering the topics of aquaculture; Agent Orange; food, science and agriculture, in conjunction with the Consultative Group for International Agricultural Research (CGIAR); and acid rain, in conjunction with the University of Vermont. NAL has also begun converting a unique collection of materials on food irradiation into machine-readable form to facilitate access and is working with the American Society of Agronomy to issue their publication, the Journal of Agronomy, on CD-ROM.

The National Science Foundation's NSFNET telecommunications network is serving as the backbone for a project which enables NAL to deliver documents to other libraries through the high speed electronic transmission of page images.

NAL also utilizes advanced information technology to expand its capabilities and improve its responsiveness. NAL has moved to the leading edge of new technology in information science by pioneering projects on compact disks, interactive video disks, full text digitization, optical scanning technology, electronic telecommunications of library materials, expert systems, and video disk

for storage of photographs. The result of these efforts is the improvement of services to users through a faster response or a more complete coverage of subject areas.

Selected Examples of Recent Progress

NAL's Aquaculture Information Center begins Automated Tracking of User's Information Needs. One of the most significant findings of Phase I of the evaluation study to assess information needs in aquaculture was the need for automated tracking of information activities to clearly and more specifically identify state, regional, and national trends in subject areas, user groups, and volume of services. Phase II addresses this need by utilizing a Local Area Network (LAN) available in-house as well as accessible by six pilot sites located throughout the United States. The Aquaculture Information Center will track and profile data input from the six sites and the center throughout the year. A second facet of Phase II is an assessment of aquaculture resources and services of land-grant libraries (both 1862's and 1890's), various Federal libraries, and miscellaneous special and commercial aquaculture libraries and information centers across the U.S. and its territories.

NAL is host for SANlink. In September 1992, a central coordinating office for the Sustainable Agriculture Network (SAN) was established at NAL in the Alternative Farming Systems Information Center. Called SANlink, because it serves to link the widely dispersed personnel and activities of the Sustainable Agriculture Network (a consortium of universities, government, business and non-profit organizations dedicated to information exchange), the office assists with communications and the coordination of projects.

NAL's Rural Information Center Links State Offices of Rural Health to Rural Health Information Via ALF. NAL's Rural Information Center Health Service (RICHS) and the Department of Health and Human Services (DHHS) Office of Rural Health Policy are encouraging the State Offices of Rural Health to utilize the networking capabilities of ALF, NAL's electronic bulletin board. RICHS staff have been providing training to State office personnel.

Demand for Rural Information Continues to Climb. The number of information requests for rural information more than doubled (110 percent increase) from 1990 to 1991. Much of this increased demand was due to the establishment of the Rural Information Center Health Service (RICHS) that is supported by DHHS Office of Rural Health Policy. An additional 28 percent increase in reference requests occurred from 1991 to 1992.

Potential Technologies Identified to Meet Industry Needs. The continuation of NAL's technology transfer project resulted in identifying 37 different uncommercialized technologies to meet four priority needs of the hardwood industry. A sampling of innovative ideas emerging from a year-long search for technologies includes the use of (1) cryogenically-cooled knife blades for cutting wood; (2) X-ray tomosynthesis (dental equipment) to detect internal defects in logs; (3) hand held infrared scanners to detect disease in trees; and (4) an environmentally benign wood preservative derived from the guayule shrub.

NAL prepared reports featuring the newly commercialized technologies as well as uncommercialized ones suggested by the Departments of Energy, Commerce, and Agriculture; and NASA, as well as the university and private research systems. The reports will be distributed to the hardwood and manufacturing industries so that the technologies can be commercialized.

NAL's Animal Welfare Information Center Provides Workshops on Alternatives to Animal Use. In FY 1992, the Animal Welfare Information Center (AWIC) developed a 1-1/2 day workshop for individuals who are responsible for providing information to meet the requirements of the 1985 amendment to the Animal Welfare Act. The general goals of the workshop are to provide an overview of Federal animal welfare regulations, a definition of alternatives to animal use, and how to use databases

and AWIC resources to obtain information on animal welfare. These workshops have been conducted at NAL, universities and research institutions throughout the United States.

NAL and Extension Launch New Directions for Youth Development. In 1992, the Youth Development Information Center directed efforts and funding to take greater advantage of evolving communications and computer technology. This includes CYFERNET, the Child, Youth, and Family Education and Research Network, which is a joint project of the Extension Service's communications information technology, home economics and human nutrition, and 4H and youth development programs and the NAL. Hardware has been installed and a number of cooperative agreements have been initiated to identify and manage a wide array of information relevant to youth and family development in electronic form.

Guide to Federal Research Facilitates Information Access.

Tapping Federal Technology: Inventions, Expertise, and Facilities is a 220-page publication containing descriptions of 158 ways people can find out about Federal research programs. The guide identifies sources of information such as clearinghouses, information centers, catalogs, databases, and bulletin boards, and provides descriptive information about these sources. This publication is a collaborative project of the National Agricultural Library and Federal Laboratory Consortium (FLC) of which USDA and its agencies are members.

NAL Increases Cooperative Cataloging Efforts. In 1992, the National Agricultural Library was selected as a new participant in the National Coordinated Cataloging Program (NCCP), a Library of Congress (LC) Cooperative Cataloging Program whereby a selected group of libraries produce in full, high quality cataloging for the LC database as well as their own bibliographic utility. After the program has been reviewed by LC, NAL will begin participation during 1993.

Global Change Information Packet Available from NAL. As part of USDA's Research Team, NAL prepared an information packet on global climate change which was made available free of charge to the news media and the general public. Five thousand copies were distributed in FY 92. Because the packet generated so much positive feedback and the demand for it was so great, it was revised and updated, and 10,000 copies are being prepared for distribution. NAL has continued cooperative efforts with other Federal libraries to identify data sets relevant to global change research and to establish and standardize procedures for their shared use and dissemination.

First Plant Genome Database Released. NAL's Plant Genome Data and Information Center has made public the first of its database products. This database, which may serve as a model for other developing plant genome databases, is a database for the *Arabidopsis* research community. Work progresses on other database efforts with major releases being imminent.

Food Labeling Education Information Center Established at NAL. USDA's Food Safety and Inspection Service and DHHS Food and Drug Administration, through an interagency agreement, have chosen NAL's Food and Nutrition Information Center to house their Food Labeling Education Information Center. The food labeling education program encourages the exchange of information about the public education campaign for the new food label. The cornerstone of the Center is a database of diverse activities and materials relevant to food labeling education. Staff solicit and acquire listings from consumer groups, industry associations, health professional associations, voluntary health organizations, private companies, and government agencies.

Direct Digital Delivery of NAL Color Slides to Personal Computers. Selected color slides are being provided to CompuServe to digitize and make available directly to end users on a national basis. This service will increase awareness of the agriculturally-related slide collections at NAL.

Cooperation Continues between NAL and the Agricultural Research Service. NAL and ARS continue to cooperate to strengthen ARS libraries and to implement mechanisms for scientists in remote research laboratories to more effectively access computer information systems, networks and other resources. A steering committee consisting of NAL and ARS administrators, Regional Research Center directors, librarians, and scientists, has been formed to ensure attainment of the goal of establishing an "electronic library" network for ARS.

NAL Plays Key Role in Support of the National Food Service Management Institute. NAL provides in-depth reference services and lends research and training materials to persons involved in the USDA's child nutrition programs throughout the Nation. Through a cooperative agreement trust fund with the National Food Service Management Institute located at the University of Mississippi, NAL serves as a clearinghouse of information and training materials available to appropriate audiences.

THURSDAY, MARCH 11, 1993.

COOPERATIVE STATE RESEARCH SERVICE

WITNESSES

JOHN PATRICK JORDAN, ADMINISTRATOR

CLARE I. HARRIS, ASSOCIATE ADMINISTRATOR

WILLIAM D. CARLSON, ASSOCIATE ADMINISTRATOR, OFFICE OF GRANTS AND PROGRAM SYSTEMS

ARTHUR KELMAN, CHIEF SCIENTIST, NATIONAL RESEARCH INITIATIVE COMPETITIVE GRANTS PROGRAM, OFFICE OF GRANTS AND PROGRAM SYSTEMS

STEPHEN B. DEWHURST, BUDGET OFFICER, DEPARTMENT OF AGRICULTURE

INTRODUCTION OF WITNESSES

Mr. DURBIN. Good morning and welcome to this hearing of the Subcommittee on Agriculture, Rural Development, Food and Drug Administration, and Related Agencies. We are going to entertain witnesses today from the Cooperative State Research Service, and I am happy to recognize the attendance of Dr. John Patrick Jordan, Administrator, as well as Clare Harris, William Carlson, Arthur Kelman and Steve Dewhurst.

Dr. Jordan, your statement concerning the status of the Cooperative State Research Service and projections for the next year will be included in the record in its entirety. We invite you, at this point, to highlight or summarize it, and we can ask some questions after that.

Please proceed and welcome this morning.

STATEMENT OF DR. JORDAN

Dr. JORDAN. Mr. Chairman and members of the subcommittee, I am so pleased to be here. There are a number of reasons that you could all articulate well as to why American agriculture is the envy of the world. One of those is that we have an enormous scientific base. We have a system that is driven—science driven, and we also have gone to the point of packaging that and delivering it to the user, the farmer, rancher, consumer or environmentalist, as appropriate, in the United States.

One of the components, in addition to the very strong Federal laboratory system that we have, has been the involvement of the university-based system for supporting this important endeavor. It is through joint planning and scientific review of projects and programs, that we have been able to focus Federal resources on both perennial and emerging problems in agriculture, which are all related to the provisions of the Farm Bill and the priorities of the Joint Council on Food and Agricultural Sciences, with an enormous

input from the user public, not only commodity-related persons, but also consumer organizations, environmental groups and so forth, and also from the Users Advisory Board, and having that kind of input to help us direct our programs.

The range of programs, as you are well aware, goes from very fundamental through applied and very mission-oriented programs to those that go to the very edge of commercialization, taking it out to where the commercial firms can determine whether, in fact, this is a worthy thing to invest in.

The partnership that has been developed involving the university-based system traces back over to 130 years. In fact, this relationship began the first year that the United States Department of Agriculture was established. And that has been built on, not only through the colleges of agriculture, but in subsequent years, the establishment of the State agricultural experiment stations, the colleges of veterinary medicine, the schools of forestry, and the colleges of home economics. They are all involved in this program, and a number of other institutions, not of the land grant variety, are also a part of it.

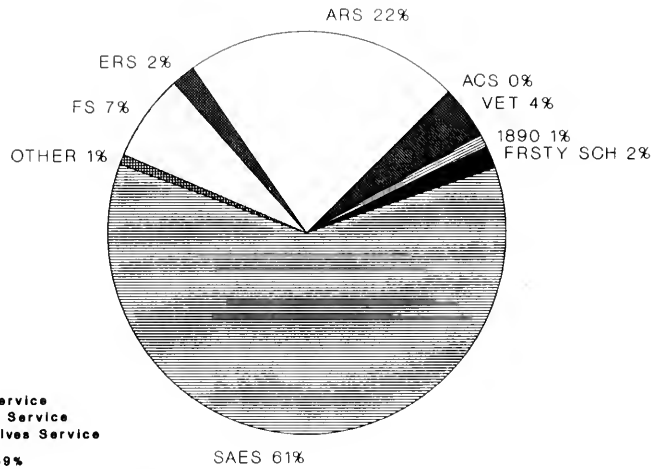
And more recently with the advent of the competitive grants program, the National Research Initiative, Federal laboratories, private laboratories, anyplace where the talent can be found we are able to access.

We are able to build in this system with about 45,000 people. With this total, which has about 13,800 at the principal investigator level of seniority, we are able to support that system with a small Washington-based staff of 230. That is our current ceiling for that program, and we are able to do it on a very, very low overhead.

Personnel-wise, that would be less than one-half of one percent. Dollar-wise, it is a little larger than that, but personnel-wise it is very, very small, indeed. The system, as the chart will show you over here on the right, accounts for, in terms of the performers of agricultural research, between 68 and 69 percent of the activities conducted in this mode. That would include the colleges of forestry, veterinary medicine, home economics and so forth, as well as the agriculture colleges, agricultural experiment stations and the other institutions that I have already identified.

[The chart follows:]

AGRICULTURAL/FORESTRY RESEARCH BY PERFORMING ORGANIZATION



USDA Programs 31%

FS-Forest Service
ERS-Economic Research Service
ARS-Agricultural Research Service
ACS-Agricultural Cooperatives Service

UNIVERSITY PROGRAMS 69%

1890-Historically Black Land-Grant Universities
VET-Colleges of Veterinary Medicine
FRSTY SCH-Forestry Schools
SAES-State Agricultural Experiment Stations

11 Feb 1993

Dr. JORDAN. That means that we are leveraging in, and they are bringing to the planning table, Mr. Chairman, that system, over $2 billion worth of agricultural research, of which the Federal investment is a little less than half-a-billion dollars. So for about 25 percent, we are influencing the direction, the strategic planning and investment of those dollars, and we are influencing far beyond the Federal investment on a dollar-for-dollar basis.

That is one of the critical elements about this agency. It is at the pivot center of the strategic planning of this entire system.

CSRS PROGRAM

We have four components to the program; one called the partnership part of the program, the Hatch Act, McIntire-Stennis for forestry research, Evans-Allen for the research at the 1890 Institutions and the Animal Health and Disease Program, which focuses heavily on the colleges of veterinary medicine. This program accounts for about 51 percent of the CSRS research and education budget, which is about 12 percent of the total amount that the system has overall. But it builds that base, that strong foundation upon which the spikes of excellence are built from a number of other sources.

NATIONAL RESEARCH INITIATIVE ON AGRICULTURE, FOOD AND THE ENVIRONMENT

One of those sources has been the National Research Initiative on Agriculture, Food and the Environment. This program was first funded in fiscal year 1991, subsuming into it an earlier competitive grants program. It was funded at $73 million the first year, and the last two years at $97.5 million.

This program has six components to it. The first year there were only four of them. That included the natural resources and the environment; nutrition, diet, food safety. It also included the plant systems, which includes the plant genome mapping program. This is a part of the overall program under the supervision of the Agricultural Research Service and the animal systems part of the program which similarly contains a sub-program for animal genome, and it is part of that overall program as well.

Two new programs were implemented successfully in 1992. One of them is on rural development, markets and trade, and the other one focuses on new products and processes for adding value.

Maybe the important point, Mr. Chairman, in this quick summary of this program is to emphasize that although it is housed in the Cooperative State Research Service, it really serves the entire department. The Board of Directors for this program includes the Administrators of the Agricultural Research Service, CSRS, the Extension Service, the Economic Research Service, Deputy Chief of the Forest Service for Research, the Director of the National Agricultural Library, and the Chief Scientist of the NRI. Policy is made all under the supervision and the chairmanship of the Assistant Secretary for Science and Education.

SPECIAL RESEARCH GRANTS AND OTHER GRANT PROGRAMS

A third program area is the Special Grant Program and other grant programs, which allow us to concentrate on the issues of national and broad regional interest. I think the important areas to identify here include integrated pest management/biological control, minor use animal drugs, National Biological Impact Assessment Program, IR-4 pesticide clearance, pesticide impact assessment, water quality and global change.

In that package, Mr. Chairman, there is a small program called SARE, the Sustainable Agriculture Research and Education Program, which is funded at $6.7 million. There is a lot more research going on that is sustainable agricultural oriented, but this is kind of the core of the program. It has four regional programs which are organized to involve directly in the planning and the execution of it farmers and ranchers, agribusiness people, private nonprofit organizations, governmental scientists, academic scientists and so on, all working together for the same end point.

Also in the special grant category is the $4 million program for research at the four regional research centers for aquaculture, the fastest growing area of agriculture in America.

And finally, it also has the supplemental and alternative crops program funded at $1.1 million. It is an area where research and development on industrial products and processes, including rapeseed, crambe, and guayule are worked on.

We have some others in there which I will speak to you more about at the biotechnology hearings later on in April, but the Biotechnology Risk Assessment Program is a new program that ARS and CSRS have unfolded the last fiscal year to address and support biotechnology research and regulation. We have put approximately $1.4 million in that program in fiscal year 1992, and $1.7 appears to be the figure for fiscal year 1993.

HIGHER EDUCATION

The fourth and last area of our programmatic arena is higher education, focusing on the national goal of excellence in education. A number of items that were put in our portfolio have turned out to be extremely useful. One of those is the National Needs Graduate Fellowship Program. That attracts a tremendous quality of students. Average Graduate Record Exam for those students exceed 1,300 across the board. We have had about 600 students in total, launching about 63 each year. Those in biotechnology exceed 1,400 on their GRE. That compares to the engineering graduate students, which generally are in the range of 1,081, those declaring an interest in medicine at about 1,000, and those declaring an interest in agriculture generally in the area of 963. So we are attracting a whole new quality of student. Many of these students would never have come to agriculture I think if it weren't for this program.

You also have put in the Capacity Building Program for the 1890 Institutions, a tremendous boom that has allowed the mainstreaming of those important institutions into the land grant system and into the Agriculture Experiment Stations and extension system better than it has ever been before.

Finally, there is a small program which requires dollar-for-dollar matching, the Challenge Grants Program, which has allowed tremendous improvement in the curricula for higher education in agriculture.

BUILDINGS AND FACILITIES

Also in our portfolio is the Buildings and Facilities Program, which was funded at $52.1 million in the current fiscal year for land acquisition, construction, improvement, repair, alteration, purchase of fixed equipment and facilities to carry out agricultural research, extension and teaching programs.

ACCOMPLISHMENTS

Each year the Chairman has allowed me the privilege of talking about some success stories, and I will not occupy a lot of time in this arena, Mr. Chairman, with your permission. What I will say is that your bag is chock-full of results of research, each item of which has appended to it a summary of the research behind it, the why, the wherefor, what was done, how it was done, and what the significance of this research is. I will just bring to your attention two or three items.

First of all, I hope you will take an opportunity to try the muffins. They are unique, and they come out of the University of Maine. I wonder if you would hazard a guess to what it is made out of. Obviously, the tag says potato peelings, and so what I want to tell you is that that is the source of the flour. It tastes like a good, nutty, whole wheat kind of muffin.

You will like it, and it has taken what is a major waste product in the State of Maine and other parts of the country and turned it into a very viable product. A couple of other things you have in your bags up there, a set of silverware with—it even has——

Mr. SKEEN. Silverware?

Dr. JORDAN. Well, flatware. Flatware may be better. I was just wondering whether you liked the pattern that we selected.

But in any case, a significant point is that this is 100 percent biodegradable. It is made from carbohydrate material and it was designed to meet the specs of the United States Navy, which must by 1994 have all its material that is dumped overboard biodegradable. Obviously it is significant for the Army or for McDonald's or anybody else that uses this kind of utensil.

Mr. SKEEN. You don't need to recycle?

Dr. JORDAN. You don't need to recycle; that is right.

Another item that is in your bag is flax. It is a fiber flax. Gosh, you are going to say, hey, when I was a youngster we used to grow that kind of stuff, but for 30 years the United States hasn't grown any fiber flax. We have grown flax, but it is all for oil and it is a different kind of flax entirely, and this is a new——

Mr. MYERS. It looks like hair.

Dr. JORDAN. Yes, it does look like hair. But it is particularly useful in making materials, and a potential for clothing, as well. It is very, very useful, and an alternative crop in many areas of the country. The experiments are being done at the Connecticut Agricultural Experiment Station in New Haven.

The final item I will bring to your attention that is not in your bag is a Kenaf boom. On other occasions we have talked to you a bit about Kenaf as an alternative in terms of newsprint and things like that, but this is for absorbents of oil spills and so forth, and it picks up an enormous amount of oil. It is a particularly good absorbent material, which shows another alternative use.

Mr. Chairman, that concludes my prepared remarks, and I and my colleagues of course will be pleased to answer questions.

[CLERK'S NOTE.—The chief scientist's biography appears on page 647. The administrator's prepared statement appears on pages 648 through 662. The budget justifications, which were received April 28, 1993, appear on pages 663 through 771.]

OVERHEAD RATES

Mr. DURBIN. Thank you, Dr. Jordan. Let me ask you about overhead rates.

Now, it is my understanding that by the mandate of this Subcommittee you are limited to a 14 percent overhead rate in your competitive grants, whereas in the special grant category, the congressional earmarks, there is no overhead allowed.

Can you give me an idea whether or not we might be able to impose the same standard on competitive grants as we do on special grants, zero overhead rate, and what impact that might have on the research?

Dr. JORDAN. Mr. Chairman, as I am sure you are fully aware, indirect costs are real costs; they are not fabricated costs. On the other hand, what we have done in the special grant arena and what we have always done in the Hatch, McIntire-Stennis, Evans-Allen, Animal Health and Disease Programs, is argue that we are in a partnership with an institution, and therefore, the partners don't levy indirect costs on one another. The competitive grants started out with quite a different history. The Department of Defense in particular, which, in the 1940s and 1950s, asked institutions of higher learning to conduct work for them. Sometimes they did not wish to do that work, and the argument was that it costs us some to do it and they questioned the academic value of it. Out of that came in the 1950s the concept of full reimbursement of indirect costs.

I have been on the committee, representing the Department of Agriculture, organized through the Office of Management and Budget to address this very issue. There are two dimensions that are worth mentioning here.

One is that the administrative costs associated with indirect costs are very often a function of what the institution puts in that overhead pool. Therefore, they have a lot more influence over it than we do as agencies, per se, and that ought to be controlled. I think you will find the executive branch interested in doing exactly that.

The second question is one that people are hesitant to tackle, and that is the question of whether it is in the basic charge of the institution to conduct graduate research. Therefore, if it is so, what share of that kind of cost should there be between the Federal Government, who is funding it, and the university where it is being conducted. And so the issue here is one of who is going to cover it.

We do have a few people, mostly in the SBIR program, Mr. Chairman, that have refused to accept our grants because the indirect cost is as low as it is. Not many, but we have had some. Most of them know that at the front end they are not going to be able to get full recovery.

We have had a couple of universities refuse us in terms of the competitive grants program with the 14 percent limit. I think they are hoping that maybe it will come back as an issue of a consistent rate across all the Federal agencies that are funding research at that level and figure, well, we will put up with it in the meantime.

Mr. DURBIN. So what is your best estimate if we allowed zero percent overhead rate?

Dr. JORDAN. I think you would have a large number of institutions that would, in fact, reject our grants.

Mr. DURBIN. Are you able to estimate how much additional research we have funded over the last five years as a result of the limit on overhead rates?

Dr. JORDAN. It is difficult to determine with much accuracy additional funds made available for research with the limits on overhead rates. Each institution has an indirect cost rate negotiated by the cognizant Federal agency. Since this rate varies from institution to institution, a finite amount is difficult to calculate.

The overhead rates applied to competitive grants in FY 1988 and FY 1989 were the full Federally negotiated rates. Virtually all of these rates were based on modified total direct costs, i.e., total direct costs less equipment, subcontract costs over $25,000 and other miscellaneous items, as negotiated. In FY 1990 the overhead cap was 25 percent of total directs costs. In FY 1991 and FY 1992 the overhead cap was 14 percent of total direct costs. In FY 1990 the average rate for land-grant universities was 46 percent and the average for all universities, including land-grants, was 51 percent. Since the indirect cost bases that the rates were applied against varied among some of the institutions, and the dollar amounts of items—equipment, subcontract costs, etc.—excluded from the bases varied between grants from zero to moderate amounts, exact comparisons with the cap rates, which were based on total direct costs without exclusions, cannot be made. However, by eliminating exclusions from consideration, approximate maximum amounts can be estimated. Using this approach, therefore, based on the 46 percent and 51 percent rates, we estimate that up to $11,500 and $13,800, respectively, in additional direct cost dollars potentially were made available out of every $100,000 awarded competitively under the 25 percent cap in 1990. Based on the 46 percent and 51 percent rates, we further estimate that up to $19,200 and $21,500, respectively, in additional direct costs dollars potentially were made available for every $100,000 awarded competitively under the 14 percent caps in FY 1991 and FY 1992.

It should be noted that we are hearing more often that universities and/or colleges within universities are requiring the academic departments to make up the difference in the 14 percent allowance and the actual overhead costs from their budgeted research funds from other sources such as state funds.

The Small Business Innovation Research program is particularly hard hit by the limit on overhead. These small businesses often

have audited overhead rates of near 100 percent. They have no alternate resources to use and a number have had to decline the grants once awarded.

Mr. DURBIN. The President has announced a plan to limit overhead rates on research. Have you been advised as to what rate will be proposed?

Dr. JORDAN. At this date we have not been advised as to what the proposed overhead rate will be.

SPECIAL GRANTS

Mr. DURBIN. Let me ask you, we have a lot of talk about the so-called earmark grants or special grants that are designated by Members of Congress, and I notice that from year-to-year Cooperative State Research Service has even gone as far as to identify some of those as worthy research projects in their budget request. Would you comment generally on this type of research approach and whether or not it has been beneficial from a scientific viewpoint? I am talking about specifically the earmarked grants through Congressional Subcommittees.

Dr. JORDAN. We have frequently requested a focus on national impact program areas, interregional projects on pesticides and the clearance of them. They have been the areas in which we have tended to request Congress to continue to fund. On the others that are specifically added and identified for particular organization or a particular State, we always run these through a merit review program, Mr. Chairman.

I should make that clear, that no money goes out of the Agency without a merit review program. And so we review those with a merit review program, and often, those proposals will come in three or four times before it appears to be scientifically sound. So once you have given us the instructions to carry them out, we accept that and move to the job of making sure that it is scientifically sound.

Mr. DURBIN. Do you go through a net process and determine whether or not it is truly valid research, whether it is duplicative, or whether the institution has the capacity to do this research? Are all those sorts of things taken into consideration under merit review?

Dr. JORDAN. Those are the criteria that we use. You have ticked them off very well, Mr. Chairman. Our bottom line is, can we stand up in front of anybody and say that the government's investment in this has been a respectable investment with a respectable return.

If we found a great deal of duplication, overlap, or the inability of an institution to carry it out, we will return to the author and talk about it and see if there can't be a redirection.

FY 1994 BUDGET REQUEST—SPECIAL GRANTS

Mr. DURBIN. In the president's "A Vision of Change for America" a proposal appears to be made to terminate all earmarked special grants. The document also states that the proposal is made with the "understanding that Congress may find offsetting savings within the same program areas to preserve these initiatives." Last

year, the budget request for special grants was $28,918,000. What will your fiscal year 1994 request total and how will it be different from your 1993 request?

Dr. JORDAN. A table will be supplied for the record which identifies the special grants requests for fiscal years 1993 and 1994.

[The information follows:]

SPECIAL RESEARCH GRANTS—FISCAL YEARS 1993 AND 1994 BUDGET REQUESTS

[In thousands of dollars]

Project	Fiscal year— 1993	1994
Energy biomass/biofuels		1,000
Global change	4,000	3,000
Integrated pest management/biological control	5,000	7,000
Minor use animal drugs	650	650
National biological impact assessment program	300	300
Pesticide clearance	7,000	10,000
Pesticide impact assessment	2,968	2,968
Rural development centers		500
Water quality	9,000	9,000
Total	28,918	34,418

IR–4 PROGRAM

Mr. DURBIN. My next question is on the specific area that you have already mentioned, that is the IR–4 pesticide clearance program. Could you give us an idea of what the status is on that effort? I know that has been going on for several years now.

Dr. JORDAN. It has, in fact, and it has had a substantial track record. The number of clearances that have occurred over a period of time has been 4,156, to date, representing 1,041 tolerances and exemptions on food crops. In addition, there are 14 biological pest control agents that have received clearances, and for ornamental crops, a total of 3,650 labels for uses of pesticides have been issued as a result of this project.

Mr. DURBIN. I assume that is on an ongoing project.

Dr. JORDAN. Yes, sir, it is.

Mr. DURBIN. It is definitely something that we have discussed in virtually every agency appearing before us, the safety of chemicals being used in agriculture.

Please provide for the record a table which shows total USDA funding for IR–4 work for fiscal years 1992, 1993 and 1994.

Dr. JORDAN. I will provide that information for the record.

[The information follows:]

USDA IR–4 PROGRAM

[In thousands of dollars]

USDA agency	Fiscal year— 1992	1993	1994
Cooperative State Research Service:			
Hatch Act	456	482	495

USDA IR-4 PROGRAM—Continued

[In thousands of dollars]

USDA agency	Fiscal year— 1992	1993	1994
Special research grants:			
Minor use animal drugs	464	464	650
Pesticide clearance	3,500	3,500	10,000
Total, CSRS	4,420	4,446	11,145
Agricultural Research Service	2,133	2,142	2,142
Total, USDA	6,553	6,588	13,287

Mr. DURBIN. How many registrations were completed in 1992, and what is the goal for fiscal year 1993?

Dr. JORDAN. The IR–4 Project was responsible for 120 pest control product clearances for minor food crops in 1992. These included petitions for tolerances, exemptions, registrations and label amendments. IR–4 also was responsible for 116 new pesticide registrations for ornamental crops and two clearances for biological pest control agents.

Mr. DURBIN. What is the current backlog of pesticide clearance requests?

Dr. JORDAN. Currently, there is a backlog of 1,329 pesticide clearance requests on minor food crops, and a backlog of 820 clearance requests on ornamental crops.

MINOR USE ANIMAL DRUGS

Mr. DURBIN. What is the backlog on minor use animal drugs and how many were registered in 1992?

Dr. JORDAN. A total of 19 uses of drugs for minor species have been cleared by FDA since 1982. In 1992, one Public Master File was published in the Federal Register, and nine Public Master Files are under review. There are 19 on-going projects in varying stages of completion. Currently there is a backlog of 125 animal drug requests that have not received funding.

Mr. DURBIN. What is the goal for fiscal years 1993 and 1994?

Dr. JORDAN. The goal for the IR–4 pesticide clearance program is 240 food use completions and 316 ornamental completions in fiscal year 1993. There is ramp-up time of one to two years between acquisition of funds and completion of projects. With a total appropriation of $12.0 million for fiscal year 1994, the IR–4 Management and Budget Plan forecasts 478 food use completions. For the Minor Use Animal Drug Program, it is expected that four of the drugs that are currently under review will be approved in fiscal years 1993 and 1994. The program will continue to seek approval for the 19 on-going projects and will initiate research on approximately 15 new projects.

Mr. DURBIN. What financial assistance do you receive from industry?

Dr. JORDAN. In 1992, IR–4 received almost $500,000 in support from industry.

FY 1994 BUDGET REQUEST—COMPETITIVE GRANTS

Mr. DURBIN. According to the table on page 135, there will be a $2,000,000 increase in outlays in fiscal year 1994 for competitive grants. What will be the increase requested in terms of budget authority?

Dr. JORDAN. The increase requested in 1994 for the National Research Initiative Competitive Grants program is $32,695,000. The first year outlays associated with this increase is approximately five percent.

Mr. DURBIN. Please provide for the record the amounts requested, by category.

Dr. JORDAN. A table will be provided for the record which includes the requested information.

[The information follows:]

National Research Initiative Competitive Grants Program—Fiscal Year 1994 Budget Increase

[Dollars in thousands]

Category	*Requested increase*
Natural resources and environment	$8,000
Nutrition, food quality, and health	6,500
Plant systems	5,195
Animal systems	5,000
Processes and new products	5,000
Rural development, markets, and trade	3,000
Total	32,695

FY 1994 BUDGET REQUEST—FACILITIES

Mr. DURBIN. According to the table on page 122, there will be a savings of $3,000,000 in outlays in grants for facilities construction. What will be your fiscal year 1994 proposal for this program? Will you propose a competitive facilities construction program as you have in the past?

Dr. JORDAN. CSRS is not requesting any funding in 1994 for a facilities construction program.

BIOTECHNOLOGY RISK ASSESSMENT

Mr. DURBIN. On page 9 of your statement, you describe the Biotechnology Risk Assessment Program which was established in fiscal year 1992 to resolve risk assessment questions. What grants were made under this program in fiscal year 1992 and why?

Dr. JORDAN. The Cooperative State Research Service in consultation with the Agricultural Research Service, Forest Service, Animal and Plant Health Inspection Service, the Environmental Protection Agency, and the Office of Agricultural Biotechnology/Agricultural Biotechnology Research Advisory Committee identified contemporary risk assessment issues to be addressed by the Biotechnology Risk Assessment Research Grants Program. A nine-member peer panel of scientists evaluated 77 proposals and took into account: the scientific merit of the proposal, the qualifications of proposed project personnel and the adequacy of facilities and the relevance of the project to solving biotechnology regulatory uncertainty for United States agriculture. The panel recommended eight grants for award in fiscal year 1992. Projects awarded in 1992 in-

cluded two projects on investigating the stability of genetically engineered resistance to plant viruses; three projects on population dynamics, ecology and genetic stability of microorganisms; two projects on the genetic stability and dispersal of transgenic plants and one project on behavioral characteristics of transgenic fish.

Mr. DURBIN. How do you determine that a risk exists that needs to be assessed?

Dr. JORDAN. The selection of proposals in the Biotechnology Risk Assessment Research Grants Program is a two step process that first involves representatives from Federal regulatory agencies who describe areas of risk assessment research need. This advice is then formulated into a draft request for proposals—RFP. This draft is reviewed by the participating advisory agencies. Within the Department of Agriculture, the Biotechnology Council composed of representatives from all research and regulatory agencies dealing with biotechnology reviews the draft RFP. In addition, advice is sought from the Environmental Protection Agency, to coordinate our research areas and to avoid duplication.

The second step in the process is the scientific peer review panel's evaluation of the science quality and relevance to risk assessment of the proposals received. The Department feels that this two step process incorporates the intent of Section 1668 of the Food, Agriculture, Conservation, and Trade Act of 1990 to support science-based regulatory decisions for biotechnology by identifying areas of need, and by seeking sound scientific advice to identify the superior proposals.

Mr. DURBIN. Section 1668 requires that one percent of the biotech funds shall be set aside for risk assessment. If you are budgeting $1,700,000 for risk assessment in fiscal year 1993, does this mean $170,000,000 in USDA funds are devoted to biotech research?

Dr. JORDAN. In fiscal year 1992, CSRS, ARS, and FS allocated $169,290,000 to biotechnology research. Since 1992 is our most recent actual expenditure data, it is used as the basis for the one percent assessment for 1993 which will be $1,692,900.

Mr. DURBIN. Please provide a table for the record listing all USDA biotech funds, by agency, for fiscal years 1992 and 1993.

Dr. JORDAN. In addition to biotechnology research there is other USDA biotechnology related funding for regulatory activities, facilities, training, repositories, and databases. A table listing all biotechnology funds will be provided for the record.

[The information follows:]

USDA BIOTECHNOLOGY PROGRAM

[In millions of dollars]

Agency	Fiscal year— 1992	Fiscal year— 1993
Agricultural Research Service	110.30	113.85
Animal and Plant Health Inspection Service	6.30	6.60
Cooperative State Research Service	96.70	87.20
Economic Research Service	0.20	0.20
Forest Service	6.20	8.50
Total	219.70	216.35

GENOME MAPPING

Mr. DURBIN. For each of the following commodities what is the status of their genome mapping: corn, wheat, soybeans, cotton, and peanuts?

Dr. JORDAN. Genome maps as well as detailed studies in regions of genomes which control traits of agricultural importance are well under way for the mentioned species. Also, much progress has been made in developing the databases which will make the results obtained from the mapping studies easily accessible and manageable.

Mr. DURBIN. Who has participated in the mapping?

Dr. JORDAN. We will provide for the record, the locations where the research is being conducted.

[The information follows:]

Corn: University of Utah, Utah; University of Minnesota, Minnesota; Illinois State University, Illinois; Auburn University, Alabama; University of California, Riverside, California; University of Florida, Florida; Iowa State University, Iowa; University of Iowa, Iowa; Kansas State University, Kansas; Massachusetts General Hospital, Massachusetts; Michigan State University, Michigan; University of Wisconsin, Wisconsin; University of Texas, Texas.

Cotton: Texas A&M University, Texas.

Peanut: University of Georgia, Georgia.

Soybean: Northern Arizona University, Arizona; University of Tennessee, Tennessee; Ohio State University, Ohio; USDA-ARS, Beltsville, Maryland; University of Illinois, Illinois.

Wheat: University of California, Davis, California; Kansas State University, Kansas; Cornell University, New York; Montana State University, Montana.

Mr. DURBIN. Are the results of this mapping in the public domain?

Dr. JORDAN. Terms and conditions of the grants require that investigators disclose to the government results of maps and sequences. This information becomes public once the rights of the investigator/institutions concerning patents are met.

BARLEY GENE MAPPING

Mr. DURBIN. Describe the barley gene mapping project and its status compared to the mapping of other commodities.

Dr. JORDAN. Significant progress is being made in developing genetic maps for a number of major commodities including barley. However, direct comparison between commodities is difficult, as the measures of achievement and rate of progress depends on the commodity. For instance, some polyploid crops are more difficult to map than are diploids. Also, other crops have a longer history of genetic study and this too facilitates mapping progress. For instance, corn and tomato have very advanced maps because of the history of genetic research and the simplicity of the genomes of these crops. The barley genome mapping project has made significant progress by coordinating research among a number of institutions through a consortium, and has successfully drawn upon an extensive scientific base of barley genetics. The status of the barley genome map is comparable to about six or eight crops.

VEGETABLE GENE MAPPING

Mr. DURBIN. What work is underway with regard to genome mapping for some of the more common vegetables?

Dr. JORDAN. Genome maps or studies of regions of genomes which control traits of agricultural importance—for example,

insect and disease resistance, fruit ripening—are underway for the following vegetables: asparagus, bean, carrot, cabbage, cucumber, lettuce, pea, pepper, potato, onion, sweet potato, and tomato.

FISCAL YEAR 1994 BUDGET REQUEST

Mr. Durbin. Please provide for the record the fiscal year 1994 budget funding level, by program, requested by the Cooperative State Research Service to the Secretary, the level requested by the Secretary to OMB, and the final OMB allowance. Please provide this information for each of the categories reflected in the summary table on page 234 of last year's hearings.

Dr. Jordan. We will provide that information for the record.

[The information follows:]

COOPERATIVE STATE RESEARCH SERVICE
1994 History Record
Budget Authority
(Dollars in Thousands)

Program	1993 Appropriation	1994 Agency Estimate	1994 Department Estimate	1994 Budget Estimate
Payments under the Hatch Act ..	$168,785	$179,760	$172,161	$173,451
Cooperative Forestry Research .	18,533	19,738	15,754	28,045
Payments to the 1890 Colleges and Tuskegee University	27,400	30,261	28,414	28,157
Animal Health and Disease Research, Section 1433	5,551	5,912	0	0
Special Research Grants:				
Animal genome mapping	0	3,000	0	0
Animal health research	0	4,000	0	0
Animal welfare/well-being ...	0	1,000	0	0
Collaborative research in plant biology	0	1,000	0	0
Energy biomass/biofuels	0	1,000	1,000	1,000
Genetic resources, including microbial collections	0	5,000	0	0
Global change	2,000	9,700	3,000	3,000
Integrated pest management and biological control	4,457	10,000	7,000	7,000
Minor use animal drugs	464	650	650	650
National Biological Impact Assessment Program	300	500	300	300
Pesticide clearance	3,500	10,000	10,000	10,000
Pesticide impact assessment .	2,968	2,968	2,968	2,968
Rural development centers ...	500	2,000	0	500
Tropical & subtrop. research	3,320	3,320	0	0
Water quality	8,950	9,000	9,000	9,000
All other	46,952	0	0	0
Subtotal, Special Grants ..	73,411	63,138	33,918	34,418
Critical Agricultural Research	400	0	0	0
Aquaculture Centers	4,000	4,000	0	4,111
Sustainable Agriculture	6,725	6,725	6,725	6,911
Supp. and Alternative Crops ...	1,168	3,000	3,000	3,000
Rangeland Research	475	1,000	0	489
State Ag Weather Information System	400	0	0	0
1890 Center of Excellence - Sustainable Agriculture	0	750	0	0
National Research Initiative .	97,500	200,000	125,000	130,195
Federal Administration (Direct appropriation)	20,795	15,894	14,196	13,641
Higher Education:				
Graduate Fellowships Grants .	3,500	6,000	4,000	3,597
Institution Challenge Grants	1,500	3,000	2,000	1,542
Minority Scholars Program ...	0	3,000	1,000	1,000
Research Apprenticeship Prog.	0	500	0	0
AGSAT	0	500	0	0
1890 Center of Excellence - Public Policy Academy	0	600	0	0
Subtotal, Higher Education	5,000	13,600	7,000	6,139
Subtotal, Cooperative State Research Service	430,143	543,778	406,168	428,557
Morrill-Nelson	2,850	2,850	2,850	2,850
Subtotal, CSRS	432,993	546,628	409,018	431,407
Buildings and Facilities	52,101	0	0	0
Total, CSRS	485,094	546,628	409,018	431,407

PERMANENT POSITIONS

Mr. DURBIN. During last year's hearings, you proposed a staffing level of 231 permanent positions in 1993. What is your current estimate? Please explain any difference.

Dr. JORDAN. Our current 1993 estimate is 235 permanent positions, an increase of four from our previous estimate. Additional positions have been needed for administration of the National Research Initiative.

WATER QUALITY

Mr. DURBIN. What is the current status of your water quality program?

Dr. JORDAN. The Cooperative State Research Service is supporting two types of efforts with the fiscal year 1993 funding, as a part of the national initiative on water quality: a nationwide program of competitively-selected Special Research Grants; and support of five Management Systems Evaluation Areas under the Midwest Initiative on Water Quality. The Midwest Initiative is jointly conducted by the Cooperative State Research Service, State Agricultural Experiment Stations, and the Agricultural Research Service, in cooperation with the United States Geological Survey, Environmental Protection Agency, Extension Service, Soil Conservation Service, and other federal and state agencies. As part of the Midwest Initiative, research is conducted at 9 locations throughout the Corn Belt to better understand and evaluate the impacts of various agricultural production systems on water quality.

Over 400 proposals were received in fiscal year 1992 for the national Special Research Grants Program, with 79 or 19 percent funded with awards ranging from $37,620 to $225,000. Response to the Request for Proposals for the fiscal year 1993 Special Grants Program in Water Quality resulted in submission of 239 proposals which are currently undergoing peer review. Water quality research problem areas to be funded in the fiscal year 1993 program include: assessment, sampling, and testing methods; fate and transport; management and remediation practices or systems; regional application and transferability of research results; and social, economic, and policy considerations.

In February, 1993, a nationwide Conference on Agricultural Research to Protect Water Quality was held in Minneapolis, Minnesota, to report the results of the research under this Water Quality Initiative, with special focus on the systems research approach used in the Management Systems Evaluation Areas in the Corn Belt. Over 550 persons attended and heard over 250 oral and 90 poster presentations. A special User's Panel of farmers, soil conservationists, and extension personnel was selected to review the research reported to determine whether the results are answering the practical needs of farmers, ranchers, and other landowners and users.

Mr. DURBIN. Where are these funds being used?

Dr. JORDAN. The fiscal year 1993 appropriation under the National Initiative on Water Quality was $8,950,000. The awards under the national competitively-selected Special Research Grants Program in FY 1993 may be made in any State, and are based on

selected research problem areas. There were 239 proposals submitted in 1993 which are being reviewed. The recipients are not yet known. The five Management Systems Evaluation Areas of the Midwest Initiative on Water Quality are headquartered in Iowa, Minnesota, Missouri, Nebraska, and Ohio, with satellite locations in Kansas, North Dakota, South Dakota, and Wisconsin.

AFLATOXIN RESEARCH, ILLINOIS

Mr. DURBIN. Please provide a description of the work that has been done under the aflatoxin research program to date and the period of the existing contract.

Dr. JORDAN. Research conducted to date is aimed at reducing aflatoxin production in corn. Toward this end, growth of the aflatoxin-producing fungus *Aspirgillus flavus* on corn kernels is measured and resistant corn germplasm is identified. Compounds in kernels that inhibit the fungus are isolated and identified. Conventional breeding and genetic transformation methods are used to generate corn genotypes that resist infection and/or do not support aflatoxin production. The fiscal year 1992 grant supports research through April 1993. The fiscal year 1993 grant is being reviewed and will support research through April 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1990, $87,000; fiscal year 1991, $131,000; and fiscal years 1992 and 1993, $134,000 per year. A total of $486,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. This research is being conducted at the University of Illinois.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. A wound injection method has been developed for rapid inoculation of corn ears in the field with *Aspirgillus flavus* and screening large populations of plants for infection and aflatoxin production. Evaluation of fifteen commercial hybrids by this technique allowed detection of susceptible versus tolerant genotypes. None of the hybrids tested have levels of resistance high enough to control the aflatoxin problem. However, a collection of inbreds has been screened and high levels of resistance of two strains of fungus have been identified. These are being further evaluated and used in crosses. To control preharvest *Aspirgillus flavus* contamination of the maize grain, recombinant DNA technology is being used to confer elevated levels of resistance in corn genotypes to fungal pathogen invasion. The level of messenger RNAs encoding the hydrolytic enzymes which have been shown to play a role in resistance greatly increases in response to fungal infection. The genes encoding these enzymes have been obtained and will be used to introduce higher levels of resistance to the fungus by expressing them in the seed before the fungus invades the tissue. The use of fungicides to prevent post-harvest spread of the fungus was shown to be effective and additional research in fiscal year 1993 will continue this evaluation as an alternative to supplement the search for genetic resistance.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The researchers anticipate that the research may be completed in fiscal year 1995. Mr. Chairman, in keeping with the Administration's policy of awarding research grants competitively, no further Federal funding for this or any other earmarked grant is requested.

AGRIBUSINESS MANAGEMENT, MISSISSIPPI

Mr. DURBIN. Please provide a description of the work that has been done under the agribusiness management program to date and the period of the existing contact.

Dr. JORDAN. The purpose of this grant is to provide partial support for the establishment and operation of an Agribusiness Management Institute at Mississippi State University. A significant amount of total support is provided by the University. The tabulation and analysis of an extensive survey conducted of agribusiness firms in the State and the Mid-South has been completed. The data and information obtained from the survey have provided the basic inputs in the design and implementation of agribusiness management research and education programs. The fiscal year 1992 grant supports research through March 1993. The 1993 grant is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded since fiscal year 1991 and the appropriation for each year was $75,000. A total of $225,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Mississippi State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The University has developed research and educational programs to meet the stated needs of agribusiness in the State and Mid-South. These programs are being conducted in both the College of Agriculture and the College of Business and Industry. The research conducted includes the evaluation of the market potentials of kenaf, cash flow analysis of new agribusiness firms and the financial analysis of agricultural cooperatives. Also, major progress has been made in the development and implementation of a joint master's degree program in agribusiness management. Efforts are underway to seek internships for students enrolled in the program with agribusiness firms and employment upon graduation. The faculty and agribusiness leaders recognize the growing importance of a strong international dimension to agribusiness research and education programs of the Institute. Alternatives are being examined to provide faculty and students with international experience and enhance their international research and education capabilities.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The development and implementation of research and education programs have been built on needs expressed by ag-

ribusiness firms in the State and Mid-South. These needs were obtained both by an extensive survey of these firms and in-depth interviews with agribusiness firm managers. Total resources are used to support this ongoing program. Non-federal support committed to these programs by the University is substantial and considerable industry support is anticipated as the University-Industry relationships are expanded and strengthened.

AGRICULTURAL DIVERSIFICATION AND SPECIALTY CROPS, HAWAII

Mr. DURBIN. Please provide a description of the work that has been done to date and the period of the existing contract under the program for agricultural diversification and specialty crops in Hawaii.

Dr. JORDAN. This research has entered a new era. The original program consisted of two phases. Phase one identified the steps necessary to expand and diversify existing agricultural industries. Phase two was conducted in public/private collaboration to develop data and information on alternatives which would encourage actual expansion and diversification. The successful result is the identification of high commercial potential for allergen-free food products in Hawaii from white taro. The program for fiscal year 1993 is a demonstration project to create and evaluate the economic potential of these products in direct collaboration with taro seed stock producers, corn growers, corn processors, a quality certifying company and final product distribution. The fiscal year 1992 grant supports research through December 1993. The fiscal year 1993 grant has been received, is being reviewed and supports research through December 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal years 1988 and 1989—$156,000 per year; fiscal years 1990, 1991, 1992 and 1993—$154,000 per year. A total of $928,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of Hawaii's Institute of Tropical Agriculture and Human Resources.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The most important accomplishment has been the identification of white taro for allergen-free food products and implementation of a demonstration project to accelerate commercialization. Hawaii tissue culture laboratories will produce variety plantlets. The Hawaii agricultural firm C. Brewer will produce the taro, provide a site for a pilot-scale taro flour processing facility, and contribute other resources. The Kanematsu corporation of Japan and several major U.S. companies are interested in product test marketing items such as flat crackers, frozen dessert and wafer cookies.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. It is anticipated that research could be completed in 1994.

AGRICULTURAL MANAGEMENT SYSTEMS, MASSACHUSETTS

Mr. DURBIN. Please provide a description of the work that has been done under the agricultural management systems program to date and the period of the existing contract.

Dr. JORDAN. The University of Massachusetts Center for Agricultural Management Systems currently serves a regional need for the development of alternative management systems which are sustainable, biologically based and economically viable. The commodity programs now contain important plant disease and weed management components as well as insect and mite components. The inclusion of biological control programs for insects, plant diseases, and weds is shifting from the past chemically-dependent approaches for the management of pests to bio-intensive IPM. Research currently underway enhance the interdisciplinary scope of commodity programs and extension programs are rapidly delivering information to the growers. Growers are working closely with the Center for Agricultural Management Systems as well as the Massachusetts State Department of Agriculture and regional offices of ASCS and SCS. The fiscal year 1992 grant supports research through March 1993. The fiscal year 1993 grant is being processed at this time.

Mr. DURBIN. How long has this work been under way and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991 and the appropriation for fiscal year 1991 was $275,000. The fiscal year 1992 and 1993 appropriation was $261,000 per year. A total of $797,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of Massachusetts.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Funds provided by CSRS support original research and demonstration of environmentally-benign pest management systems for apple, cranberry, greenhouse, landscape, strawberry, and vegetables. The apple program is the most mature of the commodity programs and has served as a model. There are six commercial size blocks of apples that demonstrate new bio-intensive IPM approaches and six blocks that are in a transition phase of development. Both blocks are compared with conventional pest control programs. The program has achieved reductions in pesticide load to nearly the minimum possible with currently available information and a portion of the IPM program has been privatized. The cranberry program has demonstrated improvements in pest management including better timing of some pesticides, replacement of conventional pesticides with bio-rational ones—use of beneficial bacteria and nematodes to control pests—and increased use of cultural techniques. The greenhouse program, which was started recently, has initiated a monitoring procedure for the use of insecticides for the management of whiteflies on poinsettia in the greenhouse. Thus pesticides are now used more effectively and the program currently impacts on about 5 percent of the greenhouse acreage. The landscape program is in its first year and in the base-line data-gathering phase. Pesticide use in the strawberry program has

declined and 86 percent of all Massachusetts strawberry growers describe themselves as practicing IPM. These practices included biological control of insets and diseases, and tillage management for weeds. Other states are in the process of adapting Massachusetts IPM approaches for strawberries. The vegetable program is in place with emphasis on sweet corn, crucifers, potatoes, and more recently tomatoes. The projects have achieved reductions in insecticide use and potential savings in herbicide use. Achievements are especially notable for the management of the Colorado potato beetle. In summary, particular emphasis is being placed on biological control of insect and plant pathogens and the management of weed populations in priority production systems. Economic benefits have been reaped by growers due to cost savings and product quality enhancement. And growers are keenly aware that their proximity to population centers demand special diligence.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The principal investigators believe that two additional years are necessary to accomplish the objectives of the program.

AGRICULTURAL PROCESSING, GEORGIA

Mr. DURBIN. Please provide a description of the work that has been done under the program to date and the period of the existing contract.

Dr. JORDAN. The project will begin with formation of a steering committee to identify opportunities for further processing of agricultural products in Southwest Georgia. The principal investigator will conduct market feasibility studies to determine specific processing opportunities within the region. The fiscal year 1993 proposal has been received, is being reviewed and will support research though February 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant begins in fiscal year 1993 and the appropriation for fiscal year 1993 is $50,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research will be conducted at the Southwest Georgia Regional Development Center.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The proposed project will support research on agricultural processing possibilities and use that research in a program to generate capital formation and business locations.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. Researchers have not determined a specific completion date.

AGRICULTURAL TRADE, NORTH DAKOTA

Mr. DURBIN. Please provide a description of the work that has been done under the agricultural trade program to date and the period of the existing contract.

Dr. JORDAN. The objective of the North Dakota agricultural trade program is to find solutions to international trade and marketing issues for the purpose of enhancing the competitiveness and diversity of the economies of the Northern Plains States. Ten projects have been completed or are underway to assess export markets for Northern Plains agricultural and value-added products, the competitiveness of the region in the production and marketing of these products, and institutional problems restraining exportation. The fiscal year 1992 grant supports research through September 1995. The fiscal year 1993 grant proposal has been received by CSRS and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $600,000; fiscal year 1990, $592,000; fiscal year 1991, $596,000; fiscal years 1992 and 1993, $350,000 per year. A total of $2,488,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. The research is being carried out at the North Dakota Agricultural Experiment Station.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Work has been completed in assessing the trade implications of United States trade enhancement programs and the United States-Canada trade agreement. Additional work is underway on assessing trade policy implications for durum wheat, assessing export markets for mustard and value added food soybean and wheat products, and exporting beef to Japan and Taiwan.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The current research program should be completed in 1994. Research to be undertaken under the fiscal year 1993 grant should be completed in 1995.

ALFALFA RESEARCH, KANSAS

Mr. DURBIN. Please provide a description of the work that has been done under the alfalfa research program to date and the period of the existing contract.

Dr. JORDAN. This project is designed to improve utilization of alfalfa protein by beef cattle through coordinated research studies of plant breeding, forage management, and animal feeding. The fiscal year 1992 grant supported research through February 1993. The fiscal year 1993 proposal is being reviewed and will support research through February 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992 and the appropriation for fiscal years 1992 and 1993 was $125,000 per year. A total of $250,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Kansas State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Experimental protocols to evaluate the effect of harvest and storage conditions on protein quality and utilization of alfalfa hay have been established. Sample collection, preparation and laboratory analysis are under way. A collection of 1,000 accessions of alfalfa and close relatives have been assembled for evaluation of improved protein utilization.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1997.

ALTERNATIVE CROPPING SYSTEMS IN THE SOUTHEAST

Mr. DURBIN. Please provide a description of the work that has been done under the alternative cropping systems program to date and the period of the existing contract.

Dr. JORDAN. The South Carolina, North Carolina, and Georgia Agricultural Experiment Stations have collaborated, in a joint research project, to study the economic and biological feasibility of expanded production of horticultural crops in the southeastern United States, either as a complement to or as a substitute for crops currently produced. They have identified and studied a number of vegetable and small fruit crops. The fiscal year 1992 grant supports research through February 1994. The fiscal year 1993 grant is being reviewed and will support research through February 1995.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1985, $300,000; fiscal years 1986–1989, $285,000 per year; fiscal year 1990, $281,000; fiscal year 1991, $277,000; fiscal years 1992 and 1993, $278,000 per year. A total of $2,554,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. This work is being conducted at the South Carolina, North Carolina, and Georgia State Agricultural Experiment Stations.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Results of these studies provide a data base for recommendation for cooling methods for harvested horticultural crops, irrigation and fertilizer guides for peppers and tomatoes, broccoli and cauliflower seedling production, vegetable crop demonstration plots, and development of non-chemical means of regulating crop growth and development. Market windows for watermelon, tomatoes, cabbage, greenbeans and peppers within the harvest period of the three state area have been identified.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate these studies will be completed by fiscal year 1995.

ALTERNATIVE CROPS, NORTH DAKOTA

Mr. DURBIN. Please provide a description of the work that has been done under the alternative crops program to date and the period of the existing contract.

Dr. JORDAN. The fiscal year 1992 grant supports research, development, and commercialization through September, 1994. The fiscal year 1993 proposal has been received and is being reviewed.

The objective of the program is to find increased usage for existing and alternative crops in North Dakota, with primary emphasis on non-food uses. The work is divided into crop production and crop utilization activities. The major crops under development include crambe, amaranth, flax, lupines, safflower, and lentils. Use technologies nearing private sector commercialization include production of red dye from sunflower hulls, production of pectin from sunflower heads, production of industrial diacids, such as azelaic and brassylic acids, from high erucic acid and high oleic acid oilseeds, respectively, and high protein snack foods from beans.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The appropriation in fiscal years 1988 and 1989 was $500,000 each year under the Supplemental and Alternative Crops Program. Beginning in fiscal year 1990 Special Research Grant funds have been appropriated as follows: fiscal year 1990, $494,000; fiscal year 1991, $497,000; fiscal years 1992 and 1993, $700,000 per year. A total of $3,391,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The work is being conducted at North Dakota State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. In large part as a result of activities under this program, and with the collaboration of National Sun Industries of North Dakota, crambe, an alternate source for high erucic acid oils, has become a commercial crop. Commercial production has risen from 4,500 acres in 1991 to about 60,000 acres contracted for 1993. Treflan has been certified for use as a herbicide with crambe. North Dakota State has established the nation's only breeding program for crambe.

In the utilization work, the technology to recover red food dye from sunflower hulls has progressed, in conjunction with a private partner, to the point of seeking FDA approval before final commercialization. A novel technology for production of industrial diacids from vegetable oils has been optimized at the bench scale and is going to be further scaled up in collaboration with a private partner. The technology for producing pectin from sunflower heads has been run once at pilot plant scale and a devoted pilot plant study of the process is now being started. This effort will provide the only domestic pectin production technology available.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. Several of the projects are at the point of precommercial scale-up in collaboration with the private sector over the next one to two years. Other programs, particularly in crop breeding and new crop introduction, will take longer. The product devel-

opment scientists are pursuing several new technologies in the laboratory that will require two to three more years before transfer to the private sector.

ALTERNATIVE MARINE AND FRESHWATER SPECIES, MISSISSIPPI

Mr. DURBIN. Please provide a description of the work that has been done under the alternative marine and freshwater species program to date and the period of the existing contract.

Dr. JORDAN. Reserch has focused on the culture of hybrid striped bass, prawns, and crawfish. Nutritional requirements and alternative management strategies for these species are being evaluated. Economic models based on these management strategies and species are currently being refined to assist potential producers in evaluating alternative opportunities in commercial aquaculture. The fiscal year 1992 grant supports research through June 1993. The fiscal year 1993 grant proposal is being reviewed.

Mr. DURBIN. How long has the work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991 and the appropriation for fiscal years 1991, 1992, and 1993 has been $275,000 per year. A total of $825,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. Research is being conducted at Mississippi State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Evaluation of stocking rates, nutritional requirements, methods to reduce stress, and economics for hybrid striped bass production systems are well underway. The results of these studies have been used to develop alternative production strategies and economic models for hybrid striped bass production in ponds. These alternative strategies and models are currently being used by producers to evaluate the commercial potential for these alternative approaches. Results from commercial production trials using alternative management strategies for crawfish and prawns indicate potential for these two species in pond systems.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The researchers anticipate that the specific research outlined in the current proposal will be completed in fiscal year 1994.

ALTERNATIVE PEST CONTROL, ARKANSAS

Mr. DURBIN. Please provide a description of the work that has been done under the alternative pest control program to date and the period of the existing contract.

Dr. JORDAN. The team of scientists on this project have discovered new predators and diseases of bollworm and budworm in cotton, vegetables, and other crops. Pathogens of pesticide resistant cotton aphids, the threecornered alfalfa hopper, and the green peach aphid have been discovered and are being developed for commercialization. A fungus has been developed for use against cyst and root knot nematodes. Bacterial strains have been discovered

which suppress plant diseases of soybean, cotton, rice and strawberry. Biological controls have been developed for weeds, and rice varieties have been discovered which suppress weeds. The fiscal year 1993 grant is being reviewed and will support research through April 1994.

Mr. DURBIN. How long has this work been under way and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $1,400,000; fiscal year 1990, $1,382,000; fiscal year 1991, $1,391,000; and fiscal years 1992 and 1993, $1,400,000 per year. A total of $6,973,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of Arkansas.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The Center has discovered new biological control organisms for key crop pests of Arkansas and the South. This program also has discovered rice germplasm which inhibits growth of weeds and ways to utilize sunflower mulches to suppress weeds. The program is transferring this technology directly to producers by teamwork with extension specialists and by product development with industry. The degree of change in pesticide residues in the environment is being monitored for the purpose of determining the environmental consequences of implementation of alternative pest control practices.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The fiscal year 1993 proposal indicates that the research and center development will be completed in fiscal year 1999 and at that time the Center will be fully functional.

ALTERNATIVE TO DINOSEB, OREGON

Mr. DURBIN. Please provide a description of the work that has been done under this alternative to dinoseb program to date and the period of the existing contract.

Dr. JORDAN. Various weed control practices are being researched as alternatives for dinoseb in snapbeans, peas and lentils, caneberries, Willamette Valley wheat, and small-seeded legumes within the Pacific Northwest. In addition, pesticide residue analyses for establishing national tolerances using IR–4 guidelines are being conducted. Sufficient data has been generated within the past three years to support the registration for caneberries. A number of researchers in other states were funded to provide pesticide residue data to support a national tolerance for several commodities grown in the Pacific Northwest. The fiscal year 1992 grant supports research through May 1993. The 1993 grant proposal has been received and is being reviewed by CSRS.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $150,000; fiscal year 1990, $222,000; and fiscal years 1991, 1992, and 1993, $225,000 per year. A total of $1,047,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Oregon State University and Oregon is coordinating and funding additional research at Washington State University, the University of Idaho, North Carolina State University, the University of Wisconsin, and Cornell University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Alternative herbicides and their residues have been evaluated on the following crops: snapbeans, peas and lentils, small-seeded legumes, cucumber/squash, and caneberries. Additionally, studies have evaluated snapbean competition/management and weed biology in snapbeans, caneberry physiology and regrowth, and the use of allelopathic cereals in cucurbits. Sufficient data has been generated within the past three years to support an alternative registered pesticide for caneberries. Cultural practices and herbicide use are being integrated to achieve viable alternatives to dinoseb.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The current phase of this work is expected to be completed in 1995.

ANIMAL SCIENCE FOOD SAFETY CONSORTIUM

Mr. DURBIN. Please provide a description of the work that has been done under the animal science food safety consortium program to date and the period of the existing contract.

Dr. JORDAN. The research goal is to enhance the safety of red meat and poultry products for human consumption. There are five objectives. One is to develop rapid detection techniques of pathogenic organisms and toxic chemicals for use by the red meat and poultry production-marketing system. Two, develop a statistical framework from which to develop tolerance levels for these hazardous substances. Three, identify effective interdiction points and develop methods to prevent or reduce substance presence. Four, develop monitoring techniques and methodologies to detect and estimate the human health risk of these contaminants and five, develop technologies to reduce hazards and enhance quality of animal food products to complement the development of HACCP programs by USDA. The fiscal year 1992 grants support research through August 1993. The consortium's members have submitted fiscal year 1993 proposals that are being reviewed by CSRS.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $1,400,000; fiscal year 1990, $1,678,000; fiscal year 1991, $1,845,000, and fiscal years 1992 and 1993, $1,942,000 per year. A total of $8,807,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted by a consortium composed of the University of Arkansas at Fayetteville, the University of Arkansas for Medical Sciences at Little Rock, Kansas State University, and Iowa State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The consortium is organized and operated along institutional lines with a coordinator and directors managing the research program. Two committees, advisory and technical, provide advice on research planning and expertise on technical matters.

Major accomplishments by the University of Arkansas include development and patenting of a fast detection test for *Listeria monocytogenes,* development of a DNA probe specific for *Campylobacter jejuninuc,* use of ozone to decontaminate poultry chill water for recycling, dietary organic acids do not provide protection against salmonellae colonization, methods to lower bacterial counts for reprocessing broilers, and a monoclonal antibody probe for isolating *Pediococcus acidilactici* in fermented meats. The University is conducting 24 projects. These include the development of fast detection methods and assessment of techniques to remove the presence of pathogens in poultry. DNA and RNA probes and monoclonal antibodies are being researched for use as fact detectors with emphasis on *Listeria monocytogenes, Salmonella typhimurium,* and *Campylobacter jejuni.* Various chemical, mechanical, and electrical methods are being researched to remove bacterial pathogens at production and processing interdiction points. These include ozone, organic acids, electrical stimulation, thermal destruction, equipment reconfiguration, and other methods. Other research includes assessing the spread of pathogens in production and processing, identifying potential intervention points to prevent or remove the presence of health hazards, developing methods to estimate the number of pathogens on muscle tissue, evaluating the epidemiology of foodborne pathogens, and estimating consumer willingness to pay for food safety. The research will help provide a scientific basis for the development and implementation of the Hazard Analysis Critical Control Point—HACCP—system currently being implemented by the Food Safety and Inspection Service—FSIS.

Major accomplishments by Iowa State University include finding that the major source of coliform bacteria contamination occurs during cutting and packaging of pork carcasses; environmental conditions do not affect different pathogens the same, therefore requiring use of different inactivation methods; a number of different pathogenic viruses survive on meat products under typical storage conditions creating a potential human health risk; and that consumers are willing to pay more for safer meat products. Iowa State is currently conducting 17 projects on pork product safety. These studies include survival and inactivation of viruses on pork products; determining the critical points of pathogenic bacterial contamination of pork products; developing probes to rapidly identify these pathogens; determining conditions for pathogenic survival on products; assessing various methods and their effectiveness in removing these pathogens including heat, sanitizers, organic acids, and irradiation; assessing impacts of sulfa removal from swine production; evaluating means for effective technology transfer; and examining public acceptance of irradiated foods.

Kansas State University has made major progress in developing faster pathogen detection methods including development of new enrichment mediums, developing a method to monitor organophosphates and their metabolites in beef muscle, exploring the potential for aerosol contamination of meat in packing houses, and com-

pleting promising pilot projects for electronic identification methods for cattle. Kansas State is conducting 11 projects on beef product safety. Primary emphasis is on development of practical, rapid detection of pathogens including *E. coli* 0157H7, *Listeria, Campylobacter,* and several viruses. Other studies include assessing the presence of fumonisins in beef; effectiveness of cooking, freezing and use of lactic acid and surfactants to decontaminate product; decomposition of organophosphate pesticides in meat; and evaluate electronic animal identification methods for beef cattle. This research will support development of HACCP inspection.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The project's strategic plan indicates a termination date of 1998 for currently scheduled research.

ANIMAL WASTE DISPOSAL, MICHIGAN

Mr. DURBIN. Please provide a description of the work that has been done under the animal waste disposal program to date and the period of the existing contract.

Dr. JORDAN. The objective of the project is to determine the factors affecting disposal of animal wastes in an environmentally benign manner while addressing the needs of neighbors and the farm. The 1992 grant supports research through March 1994. The fiscal year 1993 proposal has been requested but it has not been received.

Mr. DURBIN. How long has this work been underway, and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991, and the appropriation for fiscal year 1991 was $37,000. The fiscal years 1992 and 1993 appropriations were $120,000 per year. A total of $277,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research is being conducted at Michigan State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The program has focused on two distinct areas: the comprehensive management of animal production and manure handling and the social aspects of the resolution of conflicts arising between livestock managers and the general public at the rural-urban interface. Initial work has concentrated on the former through collection and review of literature and development of research plans.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1995.

APPLE QUALITY RESEARCH, MICHIGAN

Mr. DURBIN. Please provide a description of the work that has been done under the Apple Quality Research Program to date and the period of the existing contract.

Dr. JORDAN. The objectives of this research grant are to develop and evaluate apple maturity indices for optimum harvest for fresh market and storage; determine the role of ethylene in the expression of ripening related genes; and develop better storage methods for preservation of apple quality. The fiscal year 1992 grant supports research through June 1993. The fiscal year 1993 grant proposal has been received and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal years 1986–1989, $95,000 per year; fiscal years 1990–1993, $94,000 per year. A total of $756,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. This work is being conducted at the Michigan Agricultural Experiment Station.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Research on apple fruit quality in storage has shown that physiological disorders can be reduced by a heat treatment prior to the fruit climacteric and fruit kept in extremely low oxygen like one or two percent do not have scald, a storage disorder. Additionally, an ELISA test has been developed to assess apple fruit maturity and ripening by detecting and quantifying the ACC oxidase enzyme.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate this work will be completed by fiscal year 1997.

AQUACULTURE RESEARCH

Mr. DURBIN. Please provide a description of the work that has been done under the aquaculture program to date and the period of the existing contract.

Dr. JORDAN. Included in the program are studies to improve production efficiency through disease and parasite control, integrated aquatic animal health, genetics, and breeding. Research under grants awarded in fiscal year 1992 extends through August 1994. In fiscal year 1993, the deadline for submission of competitive proposals is April 12, 1993. In fiscal year 1993, the research funded in this program will address aquaculture waste management. The proposals will be evaluated by a peer panel and final selection of proposals is expected to be completed by July.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1981, $500,000; fiscal years 1982 through 1985, $518,000 per year; fiscal year 1986, $285,000; fiscal year 1987, $485,000; fiscal year 1988, $660,000; fiscal year 1989, $520,000; fiscal year 1990, $563,000; fiscal year 1991, $656,000; fiscal years 1992 and 1993, $316,000 per year. A total of $6,373,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. In fiscal year 1992 grants were awarded to Alabama, Maryland, Oregon and South Carolina.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. These studies have led to a better understanding of several diseases and fish health problems affecting the industry. Research has led to improved methods for the detection and diagnosis of diseases of catfish, trout, salmon, and shellfish. Research aimed at vaccine development for important diseases of trout and catfish has led to the commercialization of vaccines. Research addressing the production of toxins in fish feeds has led to better understanding of the role of these toxins in fish health management.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be finished?

Dr. JORDAN. A termination date for this program has not been established.

AQUACULTURE, ILLINOIS

Mr. DURBIN. Please provide a description of the work that has been done under the aquaculture program in Illinois to date and the period of the existing contract.

Dr. JORDAN. Research has been initiated in the development and evaluation of closed system technology for application to commercial aquaculture. System design analysis has been completed and commercial trails and pilot studies are underway. The fiscal year 1992 grant supports research through December of 1993. The fiscal year 1993 grant proposal has been received and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992. The appropriation for fiscal years 1992 and 1993 was $200,000 per year. A total of $400,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Illinois State University at Normal, Illinois, through a subcontract with the University of Illinois.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Initial design analysis for a prototype recirculating system has been completed. Economic analysis of management strategies and on farm seedstock production has been initiated. Researchers have established cooperative efforts with commercial operations to enhance commercialization of the research findings.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1996.

AQUACULTURE, LOUISIANA

Mr. DURBIN. Please provide a description of the work that has been done under the aquaculture program in Louisiana to date and the period of the existing contract.

Dr. JORDAN. Research has focused on crawfish, redfish, and hybrid striped bass in commercial aquaculture. Basic research and applied research have been conducted as well as field testing of

technologies developed. The fiscal year 1992 grant supports research through December 1993. The fiscal year 1993 proposal has been requested but has not yet been received.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Research to be conducted under this program will continue research initiated under the Aquaculture General program in fiscal years 1988 through 1991. The work supported by this new grant category began in fiscal year 1992 and the appropriation for fiscal years 1992 and 1993 was $390,000 per year for a total of $780,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is begin conducted at Louisiana University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The university has completed studies in the areas of nutrition, fish health, production management strategies, alternative species and broodstock development. Field testing in cooperation with commercial producers is also under way. Commercialization of important technologies developed from this research have led to improved production efficiency and profitability in the aquaculture industry.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be competed in fiscal year 1996.

AQUACULTURE RESEARCH, STONEVILLE, MISSISSIPPI

Mr. DURBIN. Please provide a description of the work that has been done under the aquaculture research in Stoneville, Mississippi program to date and the period of the existing contract.

Dr. JORDAN. The primary objectives of this research are to improve practical feeds and feeding regimes and to determine the causes of off-flavor in channel catfish and develop treatments to reduce the incidence of off-flavor in ponds. Additionally, scientists are evaluating the application of acoustical instrumentation in commercial aquaculture. The fiscal year 1992 research grant extends through September 1993. The fiscal year 1993 grant proposal is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal years 1980–81, $150,000 per year; fiscal year 1982, $240,000; fiscal years 1983–84, $270,000 per year; fiscal year 1985, $420,000; fiscal years 1986–87, $400,000 per year; fiscal year 1988, $500,000; fiscal year 1989, $588,000; fiscal year 1990, $581,000; fiscal year 1991, $600,000; and fiscal years 1992 and 1993, $700,000 per year. A total of $5,969,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The grants have been awarded to the Mississippi Agricultural Experiment station. All research is conducted at the Delta Branch Experiment Station, Stoneville, Mississippi. The acoustical research in aquaculture will be conducted in cooperation

with the National Center for physical Acoustics at the University of Mississippi.

Mr. DURBIN. What has been accomplished to date, and what work remains to be done?

Dr. JORDAN. The research has led to an improved understanding of the sources and causes of off-flavor in commercial catfish ponds. Initial trials to control off-flavor using copper sulfate will be initiated this year. Research in the area of feeding strategies has led to improved feeding efficiency and diet formulation. Studies using acoustical instrumentation have demonstrated possible applications in commercial aquaculture.

Mr. DURBIN. When do the principal researchers carrying out this research anticipate that the work will be completed?

Dr. JORDAN. The researchers anticipate that the research on off-flavor will be completed in fiscal year 1996.

ASPARAGUS YIELD DECLINE, MICHIGAN

Mr. DURBIN. Please provide a description of the work that has been done under the asparagus yield decline program to date and the period of the existing contract.

Mr. JORDAN. The project has sought to develop a comprehensive and integrated management program for asparagus to limit declines in yield and quality and to facilitate replanting in previous asparagus fields. Soil populations of pathogenic *Fusarium* species are the principal and ultimate cause of plant dealth. Research is aimed at suppressing these populations using soil amendments such as cabbage leaves and nitrate fertilization and through genetic alteration of asparagus to increase its resistance to decline. The fiscal year 1992 award funds the research through May 1993. The fiscal year 1993 grant is being reviewed and will support research through May 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: $100,000 per year in fiscal years 1984 and 1985; $95,000 per year in fiscal years 1986 through 1989; and $94,000 per year in fiscal years 1990 through 1993. A total of $956,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. This research is being conducted at the Michigan Agricultural Experiment Station.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The research demonstrated that soilborne *Fusarium* fungi are primarily involved in asparagus decline. These pathogens are widely distributed in Michigan and elsewhere and consist of several genetically distinct strains. It was determined that residues of cruciferous crops such as cabbage and rape reduced the population of the pathogen in soil and that nitrate rather than ammonium fertilizer consistently reduces root infections. Research into the use of soil-borne actinomycetes for biological or chemical control of root infections focused on purification and testing of the active compound from the actinomycete as well as the study of the use of cell suspensions of these organisms for biological control. Promis-

ing results from these studies will be actively pursued in fiscal year 1993. Resistance to *Fusarium* species has been uncovered through somaclonal variation in tissue culture, yielding variants that are more resistant than the parent genotype. Transformation experiments have resulted in the production of two lines of plants containing a gene which confers general resistance against fungi and bacteria and the testing of these plants for *Fusarium* resistance is underway.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The researchers anticipate that most of the current research objectives can be completed by fiscal year 1995.

BABCOC INSTITUTE FOR INTERNATIONAL DAIRY RESEARCH AND DEVELOPMENT

Mr. DURBIN. Please provide a description of the work that has been done under the Babcoc Institute program to date and the period of the existing contract.

Dr. JORDAN. The Babcoc Institute for International Dairy Research and Development has been established with the participation of the University of Wisconsin-Madison College of Agriculture and Life Sciences and School of Veterinary Medicine and the University of Wisconsin-Extension Cooperative Extension Division. The development of the Institute is in the pilot phase. The overall objective of the Babcoc Institute is to link the U.S. dairy industry with the rest of the world through degree training, continuing education, technology transfer, adaptive research, scientific collaboration and market analysis. The fiscal year 1992 grant supports work through June, 1993. The fiscal year 1993 grant proposal from the University has been received and is currently under review.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992 and the appropriation for fiscal years 1992 and 1993 was $75,000 per year. A total of $150,000 has been appropriated. CSRS has requested the University to submit a grant proposal for fiscal year 1993 which has been received and is currently under review.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at The University of Wisconsin-Madison College of Agriculture and Life Sciences.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The activities to date have related primarily to startup of the Institute. An Acting Director has been appointed and a faculty advisory group established, space for the Institute identified, and hiring of an outreach specialist is in progress. Plans for the first Babcoc Conference which will address Impacts of the North America Free Trade Agreement for the Dairy Industry of the Midwest are in progress for September, 1993 just prior to World Dairy Expo in Madison. Development of foreign language extension materials is underway as is the development of a newsletter and a reprint series. The Institute is playing a role in two dairy development projects in Latin America.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work currently underway will be completed in June 1994.

BEAN AND BEET RESEARCH, MICHIGAN

Mr. DURBIN. Please provide a description of the work that has been done under the bean and beet research program to date and the period of the existing contract.

Dr. JORDAN. The research conducted to date has been focused on the development of commercially and agronomically viable alternative cropping systems, utilizing forage legumes along with narrow row widths, for production of dry beans, sugar beets and assorted crops. Major efforts have been made to evaluate yield relationships necessary for the rapid adoption of this technology. The 1992 grant has been awarded and supports research through April 1993. The 1993 grant has been received and is being processed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1978, $45,000; fiscal years 1979–1980, $50,000 per year; fiscal year 1981, $75,000; fiscal year 1982, $82,000; fiscal years 1983–1985, $97,000 per year; fiscal years 1986–1988, $93,000 per year; fiscal year 1989, $190,000; fiscal year 1990, $188,000; and fiscal years 1991, 1992, and 1993, $189,000 per year. A total of $1,817,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. This research is being conducted by the Michigan Agricultural Experiment Station.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Research to date has shown a yield advantage for corn, dry beans, and sugar beets grown in 22 inch rows versus conventional 30 inch rows. The economic advantage for several farming enterprises growing dry beans and sugar beets ranged from $11 to $20 per acre over variable costs including machinery.

The results from these studies show that growers can use the same tillage practices on narrow rows as used on wider rows. No tillage methods are being studied. The number of plants in ridge tillage was reduced for both dry beans and sugar beets resulting in lower yields.

Sugar beets following corn production indicates a yield reduction. This reduction is probably due to an interactive effect of residual corn herbicides with sugar beets herbicides.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate the drought tolerance study with dry beans will be completed in fiscal year 1997. Work on evaluation and selection for improved biological nitrogen fixation in beans is expected to be completed in fiscal year 1998.

BEEF CARCASS EVALUATION AND IDENTIFICATION

Mr. DURBIN. Please provide a description of the work that has been done under the beef carcass evaluation and identification program to date and the period of the existing contract.

Dr. JORDAN. The overall objectives for the project are: develop an ultrasound based grading system; understand the mechanism of genetic control of beef carcass merit traits; and improve genetic evaluation for beef carcass attributes. The fiscal year 1992 grants terminate between February 1993 and March 1994. CSRS has requested the four universities to submit grant proposals for fiscal year 1993. The proposals have been received and are being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992 and the appropriation for fiscal years 1992 and 1993 was $210,000 per year. A total of $420,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of Illinois, Texas A&M University, Iowa State University, and the University of Georgia.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Progress has been made on each of the objectives identified for this project. The University of Illinois is in the final stages of completing the construction of the ultrasound data acquisition system and has successfully obtained images of carcasses using a commercial ultrasound scanner. Scientists at Texas A&M University have screened microsatellite markers, prepared DNA samples for analysis, and developed statistical methodology and computer software for genetic analysis. Iowa State University scientists have determined the accuracy of real-time ultrasound images to predict rib eye area and fat cover and to make adjustments for body composition changes. Researchers at the University of Georgia completed several studies to examine real-time ultrasound for live animal evaluation and used live animal and carcass measurements to predict beef carcass merit.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1996.

BEEF FAT CONTENT, IOWA

Mr. DURBIN. Please provide a description of the work that has been done under the beef fat content research program to date and the period of the existing contract.

Dr. JORDAN. The overall goal of the project is to demonstrate the ability to implement and manage systems of cattle breeding and production targeted to specification beef markets. The fiscal year 1992 grant supports research through September 1994. CSRS has requested the university to submit a grant proposal for fiscal year 1993. It has been received and is being processed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991 and the appropriation for fiscal year 1991 was $200,000. The fiscal years 1992 and 1993 appropriations were $237,000 per year. A total of $674,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Iowa State University, Ames, Iowa.

Mr. DURBIN. What has been accomplished to date and what work remains to be done?

Dr. JORDAN. The planned research includes the following objectives: demonstrate the feasibility of using real-time ultrasound equipment to measure and genetically evaluate beef body composition; characterize individual beef cow herds relative to genetic merit for the production of specification beef carcasses; evaluate genetic merit of individual beef sires from different breeds for the production of specification beef carcasses; demonstrate the practical application of expected progeny differences in carcass merit to tailor beef carcasses to alternative specification end-points; and optimize real-time ultrasound imaging to accurately measure body composition in live beef animals for the purpose of predicting the percent retail product. Progress on each of the objectives varies according to the stage of the research. Research has shown that backfat and ribeye area can be measured with sufficient accuracy using real-time ultrasound for genetic improvement programs for carcass merit.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1995.

BIODIESEL RESEARCH, MISSOURI

Mr. DURBIN. Please provide a description of the work that has been done under the biodiesel research program to date and the period of the existing contract.

Dr. JORDAN. The overall objective of the study is to develop increased uses of oilseed products, particularly biodiesel. The economic feasibility of biodiesel production and uses with varying feedstocks and feedstock cost are major subobjectives of the planned research. The fiscal year 1993 proposal has been received, is being reviewed and will support research through March 1, 1994.

Mr. DURBIN. How long has this work been underway, and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant begins in fiscal year 1993, and the appropriation for fiscal year 1993 is $50,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research will be conducted at The University of Missouri-Columbia, Department of Agronomy.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The biodiesel research program is to determine the best economic management practices for rapeseed and the uses of the coproducts developed upon extraction of the oil to be processed for diesel fuel.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1994.

BROOM SNAKEWEED, NEW MEXICO

Mr. DURBIN. Please provide a description of work that has been done under the broom snakeweed program to date and the period of the existing contract.

Dr. JORDAN. The research effort is coordinated by a Broom Snakeweed Research Task Force at New Mexico State University. Current research addresses three general areas for broom snakeweed: ecology and management studies; biological control studies; and toxicology and animal health. The fiscal year 1992 grant supports research through August 1993. The fiscal year 1993 grant has been received and is being processed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $100,000; fiscal year 1990, $148,000; fiscal year 1991, $150,000, and fiscal years 1992 and 1993, $200,000 per year. A total of $798,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at New Mexico State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Biological control continues to be a focus for control of the broom snakewood. Biological control agents under study include plant rust *Puccinia grindelaiae* and the Red-kneed grasshopper, *Hesperotetettix viridis.*

Early field studies show that the rust disease causes at least 6 percent mortality of snakeweed, and can be more effective under conditions of high humidity. In laboratory studies, grasshoppers consume half their body weight each day. In caged field trials, one to two grasshoppers killed the small plants and reduced the above ground biomass by more than 50 percent and did not feed on the blue gramma grass. Studies will be done to determine economic feasibility of these biological control methods.

In addition to biological control, the physiological responses to water stress, and herbicide application are being studied. Carrying agents are being studied to heighten control of snakeweed with less herbicide use. Prescribed burning studies have been initiated and early results indicate that March burning of new growth is better than June burning of mature growth because of seedling re-invasion.

An understanding of broom snakeweed infestations that occur and subsequently subside are being studied as the environmental factors involved in this phenomenon are not fully elucidated.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. Significant research can be accomplished in about two years. Most of the research is conducted in the field and progress is limited by the length of the growing seasons.

CANOLA RESEARCH, KANSAS

Mr. DURBIN. Please provide a description of the work that has been done under the canola research program to date and the period of the existing contract.

Dr. JORDAN. The objective of this program is the development of genetically cold-hardy, winter dormant populations of winter canola for use by public and private breeding programs to supply canola varieties suitable to the Central Great Plains. The fiscal 1992 grant supports research through June 1993. The fiscal year 1993 funding will support research through June 30, 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992 and the appropriation for fiscal years 1992 and 1993 was $100,000 per year. A total of $200,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Kansas State University and field stations at Colby, Hays, and Hutchinson, Kansas.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The research team has developed growth chamber screening techniques for selecting cold tolerant varieties, assembled a germplasm pool from which to select, hired an Assistant Scientist assigned specifically to this program, and begun screening studies for the selection and development of cold tolerant canola strains.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that it will require a number of years to develop winter hardy varieties. It is generally accepted that breeding programs take at least five years to make significant progress.

CELERY FUSARIUM, MICHIGAN

Mr. DURBIN. Please provide a description of the work that has been done under the celery fusarium program to date and the period of the existing contract.

Dr. JORDAN. This is a comprehensive and interdisciplinary program involving conventional breeding, tissue culture and genetic engineering techniques to combat soilborne Fusarium yellow disease which is the most important limiting factor in celery production in Michigan and elsewhere. The fiscal year 1992 grant currently supports research through March 1993. The fiscal year 1993 grant is being reviewed and will support research through March 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $40,000; fiscal years 1990, 1991, 1992, and 1993, $39,000 per year. A total of $196,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. This research is being conducted at the Michigan Agricultural Experiment Station.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The research continues to identify celery genes and genotypes resistant to Fusarium yellows caused by the soilborne fungus *Fusarium oxysporium* f. sp. *apii* race 2. Five somaclonal lines from selections made in 1988 for increased resistance were field tested in 1992 and were found to retain high resistance to fusarium yellows while retaining yield and horticultural quality. Seeds were sent to selected growers for field evaluation and were found to produce high yields. Testing in 1993 will involve large scale testing of the next generation. Hydrolase enzymes in celery roots may play a role in resistance and a correlation was found between the induction of the enzymes prior to infection and an increase in resistance. Research into the transformation of celery was terminated in August 1992, with research in 1993 being focused on somaclonal variation where promising results are expected in a shorter time frame.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The researchers anticipate that most of the current research objectives could be completed in fiscal year 1995.

CENTER FOR ANIMAL HEALTH AND PRODUCTIVITY, PENNSYLVANIA

Mr. DURBIN. Please provide a description of the work that has been done under the Center for Animal Health and Productivity program to date and the period of the existing contract.

Dr. JORDAN. CSRS has requested the university to submit a grant proposal which has been received and is currently under review. The goal of the research proposed is to reduce nitrogen losses in the manure of dairy cattle through the use of a mechanistic ration formulation program. Additionally, the pathway of nitrogen utilization in the environment will be studied to better understand the integration of feeding and cropping systems on Pennsylvania dairy farms with the ultimate goal of eliminating the movement of nitrogen to the environment outside the farm perimeter.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work proposed for support by this grant will begin in fiscal year 1993. The appropriation for fiscal year 1993 is $134,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research will be conducted at The University of Pennsylvania.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The research proposed is part of a larger project to control nitrogen management of dairy farms in order to improve the efficiency of utilization in feed and manure for the purpose of reducing non-point pollution of ground and surface water by nitrogenous compounds. This research will include the following objectives: development of a dairy herd model that integrates cow digestion, metabolism, milk production and waste product generation and development of a farm-level nutrient management model that integrates the dairy herd model with nitrogen cycling and crop growth models.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1994.

CENTER FOR RURAL STUDIES, VERMONT

Mr. DURBIN. Please provide a description of the work that has been done under the Center for Rural Studies program to date and the period of the existing contract.

Dr. JORDAN. The university plans to develop technology and marketing assistance programs for small business and family farms. The fiscal year 1992 grant supports research through August 1993, and a report on this activity will follow after that time.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work support by this grant began in fiscal year 1992 and the appropriation for fiscal years 1992 and 1993 was $37,000 per year. A total of $74,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of Vermont.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Accomplishments on the first year of the project will be made available after completion of the work in August 1993. The fiscal year 1993 proposal has been received and is being reviewed.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. Work being done with fiscal year 1993 funds is expected to be completed in September 1994.

CHESAPEAKE BAY AQUACULTURE, MARYLAND

Mr. DURBIN. Please provide a description of the work that has been done under the Chesapeake Bay Aquaculture program to date and the period of the existing contract.

Dr. JORDAN. The objective of this research is to improve the culture of striped bass and the American oyster through genetics, reproductive biology, nutrition, and health management. Additionally, the research does address sensory characteristics of striped bass as well as causes of off-flavor. The fiscal year 1992 grant extends through August 1994. The fiscal year 1993 grant proposal has been requested but has not yet been received.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported under this grant began in fiscal year 1990 and the appropriation for fiscal year 1990 was $370,000. The fiscal years 1991, 1992 and 1993 appropriation was $437,000 per year. A total of $1,681,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. Research is being conducted at the University of Maryland.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Research in the area of reproductive biology indicated that hormonal implant devices were effective in inducing and synchronizing ovulation in striped bass leading to greater control of artificial spawning of this species. Gene probes have been developed to assist in the identification of specific stocks of striped bass and will be incorporated into broodstock improvement programs. Nutritional biochemistry studies indicate that moisture, texture, and flavor of striped bass were influenced by manipulation of the diet under fish culture conditions. Rapid and sensitive diagnostic tests have been developed for detection of certain viruses in striped bass. In general, the research conducted through this program should enhance aquacultural production in the Chesapeake Bay and mid-Atlantic area.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that this work will be completed?

Dr. JORDAN. The university researchers anticipate that the work will be completed in fiscal year 1995.

COMPETITIVENESS OF AGRICULTURAL PRODUCTS, WASHINGTON

Mr. DURBIN. Please provide a description of the work that has been done under the competitiveness of agriculture products program to date and the period of the existing contract.

Dr. JORDAN. This grant is for the purpose of improving the global competitiveness of agricultural and forest products, especially value-added products, produced in the Pacific Northwest through a program of research of market evaluation, product development, and policy and trade barrier studies and use of appropriate outreach programs. The fiscal year 1992 grant supports research through June of 1994. The fiscal year 1993 proposals have been submitted to CSRS and are being reviewed.

Mr. DURBIN. How long has the work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992. The appropriation for fiscal years 1992 and 1993 was $800,000 a year. A total of $1,600,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. The research program is being carried out at Washington State University, Pullman, and the University of Washington, Seattle.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Studies at Washington State University have been completed on a rapid assay for detecting blackrot in crucifer seed for export, factors causing brownleaf in Timothy hay with remedies, and export market assessment studies for apples, hay and livestock products. Ongoing projects are expanding exports of azuki beans, edamame, basabi radish, Wagyu cattle and beef, red lentils and Walla Walla onions. Several projects at the University of Washington have been completed on forest inventory and trade flows for the former Soviet Union, Eastern European countries, and People's Republic of China; competitive softwood supplies from New Zealand, Australia, and Chile; a survey of secondary wood product manufacturing capability; revision of a forest products global trade model to assess competitiveness and environmental

policy implications; a patent for a cell wall filled pulp that increases fiber yield; assessment of endangered species proposal impacts on the Pacific-Northwest forest products industry; and meetings and workshops to disseminate results. New projects include additional country studies to assess their competitiveness; assess the Japanese furniture product market; competitiveness studies of the United States millwork and wood furniture industries; assess implications of the new Common Market wood product standards; development of a strategic alliance to increase wood exports to China; evaluate implications of new environmental policies on the industry; and chemical recovery from the filled pulp project.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The agreement under which this research is being conducted terminates in 1997.

CONSOIL, WISCONSIN

Mr. DURBIN. Please provide a description of the work that has been done under the Consoil program to date and the period of the existing contract.

Dr. JORDAN. The specific project is entitled, "Farm Field Level Local Government Methodology to Implement Conservation Provisions of the 1990 Farm Bill". The project is in the process of melding Agricultural Stabilization and Conservation Service farm field level crop system data, Soil Conservation Service soils information, and county parcel based land records. The resulting data base will be used to investigate groundwater susceptibility to pesticides, and to describe a methodology for the development of such cooperative systems for local governments. For fiscal year 1993, the project proposes to develop general guidelines for the development of county databases and to begin exploration of the impact of Geographic Information System—GIS—databases on local area decision making.

The fiscal year 1992 grant supported research through December 1992. The proposal for fiscal year 1993 has been received, is being reviewed, and will support research through May 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992 and the appropriation for fiscal year 1992 was $25,000. In fiscal year 1993, $75,000 was appropriated. A total of $100,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of Wisconsin.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. This project is an enhancement of a long existing effort in Land Information Systems. The particular project began last year with a title of "Conservation of Natural Resources through Sharing of Information Layers Using Geographical Information Systems." The title is descriptive of the goal of the research. The work applies to seven counties and involves data layers derived from national and local sources. The project has become

one of the models on which most local GIS data bases are patterned.

Mr. DURBIN. When do the principal investigators carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that the objectives identified for the immediate future may be completed in fiscal year 1994.

CONTROLLED ENVIRONMENTAL PRODUCTION SYSTEMS, PENNSYLVANIA

Mr. DURBIN. Please provide a description of the work that has been done under the controlled environmental production systems program to date and the period of the existing contract.

Dr. JORDAN. Work started last year on optimizing the performance of high value horticultural crops in well controlled environments to reduce any environmental impacts on the rural and urban interface. The fiscal year 1992 grant supports research through March 1994. The fiscal year 1993 grant has been received and is being processed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992 and the appropriation for fiscal years 1992 and 1993 was $240,000 per year. A total of $480,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Pennsylvania State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Research has been initiated on various parameters to help control environment variables. Some of these studies are to evaluate alternate and recycled materials such as coal slag and rockwool to replace conventional greenhouse growing media; utilization of mulch and floating row covers to moderate and stabilize the microclimate around early market vegetable plantings; and evaluation of tensionmeters and other sensors and their control systems to manage nutrient and water inputs in greenhouse cropping systems.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1996.

COOL SEASON LEGUME RESEARCH

Mr. DURBIN. Please provide a description of the work that has been done under the cool season legume research program to date and the period of the existing contract.

Dr. JORDAN. The cool season legume program involves projects to improve efficiency and sustainability of pea, lentil, chickpea, and fava bean cropping systems through collaborative research. Scientists from participating states have developed operational plans and identified major research thrusts for this research program. Research studies have been initiated on crop improvement, crop

protection, crop management, and human nutrition/product development. The fiscal year 1992 grant supports research through August 1994. The fiscal year 1993 grant has been received and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991 and the appropriation for fiscal year 1991 was $375,000. The fiscal years 1992 and 1993 appropriation is $387,000 per year. A total of $1,149,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at agricultural experiment stations in Idaho, Oregon, Washington, Wisconsin, Minnesota, New York and New Hampshire.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Genetic studies have identified resistance in both peas and lentils to two important virus diseases. Genetic markers have been found for resistance to powdery mildew strains and DNA sequencing is under way. A method has been developed to incorporate fungi and bacteria biocontrol agents as seed treatment for root rot control in peas. Other studies are evaluating the integration of genetic resistance and chemical treatment for control of root disease. Considerable progress has been made in regeneration of whole plants from tissue culture to facilitate gene transfer using biotechnology. Weeds are a greater problem in peas grown using conservation tillage compared to conventional tillage in a wheat-pea rotation. Studies of the chemical composition of pea seeds have shown the smooth seeded varieties to be higher in total starch and water soluble protein while the wrinkled seeded ones are higher in lipids, amylase, glucose and sucrose.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The current research is anticipated to run through fiscal year 1996.

COTTONSEED EXTRACTION AND OIL REFINING, TEXAS

Mr. DURBIN. Please provide a description of the work that has been done under the cottonseed extraction and oil refining program to date and the period of the existing contract.

Dr. JORDAN. Research is aimed at developing an efficient process for the extraction, degumming and refining of cottonseed oil, using isopropyl alcohol rather than hexane as a solvent. A change in solvents is needed because of concerns about long-term toxicity effects of hexane, as well as its relatively high flammability. In the first year, the emphasis was on seed preparation and extraction of oil. Because the isopropyl alcohol solvent used in this process requires about 2.6 times the energy for vaporization than hexane, another major effort was on finding ways to reduce the energy requirements for the proposed process. In the second year, emphasis is on "cleaning up" the oil and separating the solvent for recycle. The fiscal year 1992 grant supports research through May 1993. The fiscal year 1993 grant proposal has been received and is being reviewed and will support work through May 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991 and the appropriations for fiscal years 1991, 1992 and 1993 were $75,000 per year. A total of $225,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Texas A&M University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The researchers developed procedures to reduce costs of flaking cottonseed and to reduce the oil contents in collets from 30 percent to 18 percent before extraction. They are close to reducing the net energy requirements for using the isopropyl alcohol solvent to approximately that of hexane. Chill separation tests of solvent and oil showed that the majority of free fatty acids, gums and sugars stay with the solvent, thus producing a far superior crude oil than that normally going to the refinery. A 30-person advisory committee representing various interests has been established. Four technical presentations and one publication in a trade association magazine occurred during the first year of the project.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1994.

CRANBERRY-BLUEBERRY DISEASE AND BREEDING, NEW JERSEY

Mr. DURBIN. Please provide a description of the work that has been done under the cranberry-blueberry disease and breeding program to date and the period of the existing contract.

Dr. JORDAN. The research has sought to improve disease and insect resistance and fruit quality in cranberries and blueberries. Selections from blueberry crosses and wild blueberry collections are being evaluated for desirable horticultural characteristics and for resistance to pests. Integrated pest management programs are being conducted with a focus on reducing pesticide use and on investigating alternative pest control strategies while maintaining or increasing crop yield and quality. The fiscal year 1992 award supports this research through March 1993. The fiscal year 1993 proposal is being reviewed and will support research through March 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1985, $100,000; fiscal years 1986–1987, $95,000 per year; fiscal years 1988 and 1989, $260,000 per year; fiscal year 1990, $275,000; and fiscal years 1991, 1992, and 1993, $260,000 per year. A total of $1,847,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. This research is being conducted at the New Jersey Agricultural Experiment Station.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. In cranberry, self-pollinations are less fertile and productive than cross pollinations. Over one hundred crosses are

being evaluated for desirable attributes, including early ripening, high productivity and vigor. Selection for superior seedlings will begin in fiscal year 1993. Weed control continues to be a major problem for cranberry growers, and a specific protocol for controlling redroot using fungicides had been developed including both timing and rate of application. Investigations continue on improving the effectiveness of glyphosate for the control of smilax, and on the effectiveness of pesticides for control of fireworm and fruitworm damage. The use of latewater management to improve fruit quality and for disease and insect management may also help reduce the amount of pesticide applications. Advanced selections of blueberry with high quality fruit and uniform ripening were planted in spring 1992 and are being evaluated for disease resistance. Integrated pest management monitoring for 15 insects and 3 diseases on 480 acres with 8 direct participating growers illustrated that several pest species were present at higher levels than seen in previous years. Fungicide trials on blueberries conducted with CSRS funds resulted in granting of a section 18 special label for use of Bravo on blueberries, with an industry-wide reduction in losses due to anthracnose.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The researchers anticipate that significant solutions to the many interrelated pest and production problems will require an additional three to ten years especially to develop improved cultivars.

DAIRY GOAT RESEARCH, PRAIRIE VIEW A&M, TEXAS

Mr. DURBIN. Please provide a description of the work that has been done under the dairy goat research program to date and the period of the existing contract.

Dr. JORDAN. The Dairy Goat Research Program continues to address a number of research problems that have a negative influence on goat production. Scientists have investigated regulatory proteins and mucosal traits in female goats to improve reproductive efficiency. In fiscal year 1993 research is planned to evaluate the use of genetic evaluation techniques to select goats for meat and milk production in a composite population. Live animal evaluations will aid in the development of computer simulations that can be used to predict milk and meat production. The fiscal year 1992 grant supports research through May 1994. The fiscal year 1993 grant initiates a breeding program that will be completed in fiscal year 1996. The fiscal year 1993 proposal has been received and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from appropriated funds as follows: $100,000 per year for fiscal years 1983–1985; $95,000 per year for fiscal years 1986–1988; no funds were appropriated in fiscal year 1989; $74,000 for fiscal year 1990; $75,000 per year for fiscal years 1991, 1992 and 1993. A total of $884,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Prairie View A&M University in Texas.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The research program is providing a better understanding of breeding problems in female goats raised under temperate environmental conditions. The performance of three breed types and their crosses are being evaluated to determine their genetic potential for meat and milk production. Results will be useful in improving the performance of the many small herds used in the United States.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work will be completed in fiscal year 1996.

DELTA RURAL REVITALIZATION, MISSISSIPPI

Mr. DURBIN. Please provide a description of the work that has been done under the Delta Rural Revitalization program to date and the period of the existing contract.

Dr. JORDAN. This project has gone through several phases in the delineation of a strategy for a long-range development plan for the Mississippi Delta region. Its first product was an assessment of the economic, social, and political factors that enhance or impede the advancement of the region. The second phase of the project evaluated the potential of entrepreneurship and small business creation as mechanisms to improve economic conditions. This was followed by a third phase of technical assistance to Delta region manufacturing firms to strengthen their ability to provide employment and incomes. The fiscal year 1992 grant supports research through September 1994. The fiscal year 1993 grant proposal has been requested but has not been received.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $175,000; fiscal year 1990, $173,000; and fiscal years 1991, 1992, and 1993, $175,000 per year. A total of $873,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Mississippi State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. A publication titled, "A Social and Economic Portrait of the Delta," has been published. This report serves as an analytical baseline for further work. The second phase of the project created a Delta Inventors Society to assist creative persons in developing ideas which can be successfully commercialized, and a companion Entrepreneurial Forum was established to help new business ventures with start-up advice and assistance. Finally, a Venture Capital Association was formed to help both inventors and businessmen find capital resources to carry out their plans. A report covering the creation and initial activities of these groups was prepared in 1992. Evaluation of the impacts of these efforts will continue through September 1994.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The current grant proposal refers to a "research strategy for the production of a multifaceted, long-range development plan for the Mississippi Delta region." The funding awarded to date will continue to support evaluation studies through September 1994. The timetable for funding awarded in fiscal year 1993 cannot be determined until the proposal is submitted.

DOGWOOD ANTHRACNOSE

Mr. DURBIN. Please provide a description of the work that has been done under the dogwood anthracnose program to date and the period of the existing contract.

Dr. JORDAN. In fiscal year 1991 and 1992, elevation, temperature, water stress, and humidity were evaluated for their effects on the progression of the disease. Preliminary data indicates that flowering dogwood is moderately drought resistant. Disease severity was found to be variable in forest and urban areas and light and moisture were found to have dramatic influences on disease progress. An identification of physiological differences between the various species of the fungus *Discula* has led to the development of a rapid and reliable test to distinguish species associated with *Cornus florida*, the flowering dogwood. Although there appears to be more than one species of fungus able to cause the disease, DNA fingerprinting has shown that low variability occurs within the fungal population. Selected *Cornus* species, including two flowering dogwood trees, have been identified with resistance to the fungus, and may serve as possible sources of resistance for other flowering dogwood cultivars. The fiscal year 1992 grant supported research through March 1993. The fiscal year 1993 grant proposal is being reviewed and will support research through December 1993.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991 with an appropriation of $100,000. The fiscal years 1992 and 1993 appropriation was $137,000. A total of $374,000 has been appropriated.

Mr. DURBIN. Where will this work be carried out?

Dr. JORDAN. The research is being conducted at the University of Tennessee, University of Georgia, North Carolina State University, and Virginia Polytechnical Institute and State University. The University of Tennessee will be the lead university for coordinating research toward the objectives of this grant.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The scientists will continue to study the epidemiology of dogwood anthracnose, including its geographic distribution and other environmental factors that influence the fungal pathogen, and its interaction with the plant host. These factors include light, temperature, water status, humidity,and elevation. Experiments have shown that the fungus prefers temperatures around 25° C and high relative humidity. Models based upon the data collected in the previous two year will be used for prediction of disease severity in urban, forest, and nursery environments in the southeastern U.S.

The interactions with and role of insects in the spread of the fungus will be evaluated in laboratory as well as field situations. Genetic variability of the fungal species will be studied with respect to fungicide tolerance and ability to cause disease. Individuals of *Cornus* species possessing resistance to the fungus will be studied to determine the reliability and mechanism of resistance for future incorporation into breeding programs. The support provided by this funding will allow for a cooperative effort between four states to tackle the common problem of dogwood anthracnose. The goal of this research is to develop disease management procedures and resistant dogwood cultivars.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1995.

DRIED BEAN RESEARCH, NORTH DAKOTA

Mr. DURBIN. Please provide a description of the work that has been done under the dried bean research program to date and the period of the existing contract.

Dr. JORDAN. The North Dakota Agricultural Experiment Station has been involved in evaluating the yield components, nitrogen fixing efficiency, cooking quality, seed dry matter accumulation, tolerance to micronutrient deficiency, and disease conditions affecting this crop. Two recurrent selection populations have been developed, one each for pinto and navy bean classes, composed of white mold resistant materials, and genotype possessing architectural avoidance mechanisms. Several sources of tolerance to common blight have been identified and incorporated into selections being considered for release commercially. The fiscal year 1992 grant supports research through June 1993. The fiscal year 1993 grant has been received, is being reviewed, and supports research through June 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal years 1977–1981, $25,000 per year; fiscal year 1982, $24,000; fiscal years 1983–1984, $25,000 per year; fiscal year 1985, $50,000; fiscal year 1986, $48,000; fiscal years 1987–1989, $75,000 per year; fiscal year 1990, $87,000; fiscal year 1991, $93,000; fiscal years 1992 and 1993, $100,000 per year. A total of $902,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research is being conducted at the North Dakota Agricultural Experiment Station.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. This work has resulted in the releases of Pindak, Holberg, and Nordak pinto bean cultivars. Several other new cultivars with early maturity, improved insect and disease resistance, desirable plan type, high yielding ability, good cooking quality and other features have been identified and incorporated into the breeding program. The gene pool has been expanded by the introduction of exotic germplasm from the International Bean Nursery

at the Centro International de Agriculture—CIAT. Genetic control of resistance to bean rust was found in two varieties. Calcium compounds applied to leaves have been shown to retard fungal colonization.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1995.

EASTERN FILBERT BLIGHT, OREGON

Mr. DURBIN. Please provide a description of the work that has been done under the eastern filbert blight program to date and the period of the existing contract.

Dr. JORDAN. The research on eastern filbert blight involves the development of disease management strategies for this devastating disease of hazelnut orchards. The objectives of the research are the development of commercially acceptable hazelnut cultivars that are resistant to the disease, the use of fungicide for control, and the evaluation of cultural practices that minimize the pathogen's spread and thereby limit the economic impact of eastern filbert blight within susceptible orchards. The fiscal year 1992 grant supported research through February 1993. The fiscal year 1993 grant is being reviewed and will support research through February 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991, and the appropriation for fiscal year 1991 was $75,000. The appropriation for fiscal years 1992 and 1993 was $85,000 per year. The total amount appropriated is $245,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Oregon State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Over the previous fiscal year, the following accomplishments have been achieved; knowledge of the disease cycle has been further refined and it has been determined that the site of infection is the young stem with highest susceptibility being the early spring, two fungicides show potential for control of the disease—one a protectant applied early in the spring followed by the application of a locally systemic fungicide, and several types of resistance have been determined. Genetic crosses have been made between cultivars displaying immunity and commercially acceptable cultivars. Four selections showing promising levels of resistance have been released for field testing. The process of integrating the results from breeding for resistance, timing of application of fungicides and knowledge of plant-fungus interactions has begun and will be used to develop a suitable approach for disease management.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1997.

ENVIRONMENTAL RESEARCH, NEW YORK

Mr. DURBIN. Please provide a description of the work that has been done under the environmental research program to date and the period of the existing contract.

Dr. JORDAN. The program continues to have two major thrusts which are nitrogen flows from agricultural ecosystems and their impacts on natural ecosystems and resources in a mixed ecosystem setting and the agricultural dimensions of global climate change. Other elements of the program include environmental technology transfer and environmental assessment. The fiscal year 1992 grant supports research through February 1993. The fiscal year 1993 proposal has been received, and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991 with an appropriation of $297,000. The fiscal years 1992 and 1993 appropriation was $575,000 per year. A total of $1,447,000 has been appropriated.

Mr. DURBIN. Where is this research being carried out?

Dr. JORDAN. This research is being conducted at Cornell University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Field experiments on nitrogen flows from agricultural ecosystems have shown that leaching of nitrogen from maize-based cropping systems is affected by both system type and management practices. Methodologies to improve estimation of soil nitrogen supplying capacity and to reduce nitrogen leaching are being investigated. A computer based expert system has been developed to support decision making about use of nitrogen fertilizers. Collaborative efforts with international agricultural centers have been initiated to extend use of this system to tropical countries.

Water quality studies have shown that ground and streamwaters draining forested areas surrounding agricultural lands contain little nitrate nitrogen, whereas waters under manured agricultural fields consistently exceed the 10 parts per million nitrate nitrogen standard. However, dilution of water from the agricultural areas with clean water from forests can protect major aquifer resources in mixed ecosystem landscapes.

Animal wastes have been found to increase aerial inputs of nitrogen into surrounding forests and to alter nitrogen cycling in the forest floor. The inputs of nutrients into a series of wetlands that are differentially impacted by agriculture and the effects on the structure and functioning of wetlands are also being investigated.

Scale and spatial resolution of data has been found to affect the amount of error in landscape level assessments that couple simulation models with geographic information systems. This finding is being incorporated into methodologies to model flows of nitrogen at the landscape level.

A model linking climate, crop growth, and economic systems has been used to test ability of agriculture to adapt to gradual climate change. Studies for a model, 600 acre grain farm show that viability would increase in Minnesota; would be maintained in Nebraska

with a switch to more drought-tolerant crops; and would decrease in the Southeastern United States. A workshop evaluating agricultural dimensions of global climate change was held and a book is being prepared for publication.

A field experiment was initiated and completed at Davis, California to quantify and assess methane emissions from flooded rice amended with a green manure. A manuscript detailing the results of this experiment has been prepared and is being reviewed.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that this work may be completed in 1995.

EXPANDED WHEAT PASTURE, OKLAHOMA

Mr. DURBIN. Please provide a description of the work that has been done under the expanded wheat pasture program to date and the period of the existing contract.

Dr. JORDAN. This research was designed to develop supplementation programs and new technology delivery to reduce production risk of growing cattle on wheat pasture, evaluate grazing termination date on grain and beef production, evaluate wheat cultural practices on beef production and develop an economic model to evaluate the alternative decisions on grain/beef production. The grant for fiscal year 1992 supports research through June 1993. The fiscal year 1993 grant is being reviewed and will support research through June 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $400,000; fiscal year 1990, $148,000; fiscal year 1991, $275,000; fiscal years 1992 and 1993, $337,000 per year. A total of $1,497,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Oklahoma State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Accomplishments indicated potential increased daily weight gain from feed supplements with a net profit increase of $7.00–$22.00 per head for cattle grazing of wheat pastures. Further studies are underway to evaluate expected return and risk implications of alternative stocking rate and grazing periods. Supplementation resulted in a lower whole farm net return under low price conditions, but could be beneficial when cattle prices are higher.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The scientists estimate the current phase of this research project will be completed in 1995.

EXPORT DEVELOPMENT, KENTUCKY

Mr. DURBIN. Please provide a description of the work that has been done under the export development program to date and the period of the existing contract.

Dr. JORDAN. The purpose of this program is to conduct research to support the exportation of agricultural products from the Southeastern United States. The fiscal year 1992 grant supports research through June 1993. The University has submitted a proposal for fiscal year 1993 and it is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992 and the appropriation for fiscal years 1992 and 1993 was $227,000 per year. A total of $454,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. The research program is carried out a the University of Kentucky.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. A partially completed set of studies assesses the export markets for a number of products including oilseeds, dairy products, and processed meats produced in the Southeast. The project is being extended to thoroughbred horses. A second study found that the export enhancement efforts for value-added food products should concentrate on small- to medium-sized firms. Country studies on accessing markets and describing their potential for food exports have been completed. Additional country studies are planned. Additional studies also are planned to analyze further the export markets and problems for dairy and meet products.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The agreement under which this research is being conducted terminates in 1997.

FARM AND RURAL BUSINESS FINANCE, ILLINOIS AND ARKANSAS

Mr. DURBIN. Please provide a description of the work that has been done under the farm and rural business finance program to date and the period of the existing contract.

Dr. JORDAN. These grants are being used to establish a Center for Farm and Rural Business Finance. The Center is a partnership involving the Departments of Agricultural Economics at the University of Illinois and the University of Arkansas. Research is underway in three general areas: financial management and performance of farm and rural businesses, financial markets and credit institutions serving rural America, and public policies and programs. The fiscal year 1992 grants support research through September 1993. Fiscal year 1993 grants are being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992 and the appropriation for fiscal years 1992 and 1993 was $125,000 per year. A total of $250,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. Research is being conducted at the University of Illinois and the University of Arkansas.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. At Arkansas a survey of 34 commercial banks in the western part of the State was conducted to determine bank re-

sponses to various types of loan requests. Considerable variability was found in interest rates offered. Data have been collected on the financial conditions of borrowers going into bankruptcy and the arrangements made with the banks for their emergency from bankruptcy. The analyses will produce information useful to both banks and borrowers in developing strategies for successful emergence from bankruptcy. At Illinois, analyses have been completed on credit evaluation and risk assessment procedures used by Midwestern banks; debt capacity of geographically dispersed farms; financial contracting and vertical coordination of agricultural firms; the effect of bank holding affiliation on rural credit; factors causing interest rate variation among banks; impediments to growth and expansion of food processing firms in Illinois and portfolio diversification using farmland investments. Major findings show inconsistencies in credit evaluation procedures; sellers of farm properties offer lower interest rates, lower down payments, and shorter loan maturities than commercial banks, and the benefits of including farmland investments in portfolios dominated by stocks and bonds.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The current grant is scheduled to terminate February 1994.

FARM COMPUTER TECHNOLOGY, GEORGIA

Mr. DURBIN. Please provide a description of the work that has been done under the Farm Computer Technology program to date and the period of the existing contract.

Dr. JORDAN. Cooperative State Research Service has requested the university to submit a grant proposal that has been received, is being reviewed and will support research through July 1994

The project will seek to address two questions. One thrust of the project will seek to develop a controlled environment poultry house to assist broiler producers. The other thrust will seek to define precisely the movements and forces involved in poultry processing in an attempt to facilitate improvements needed to relieve the workers in the processing industry of their most severe work related injury, carpal tunnel syndrome.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant begins in fiscal year 1993 and the appropriation for fiscal year 1993 is $100,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Most of this research will be conducted at Georgia Institute of Technology in Atlanta, Georgia.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. This work is just beginning. One thrust seeks environmental control in a broiler house through new sensors, software, and control regimes. The other thrust seeks to measure precisely the movements and forces involved in processing in order to determine causes and solutions to problems caused by repetitive motion.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1994.

FISH MARKETING, OREGON AND RHODE ISLAND

Mr. DURBIN. Please provide a description of the work that has been done under the fish marketing program to date and the period of the existing contract.

Dr. JORDAN. The purpose of this program is to conduct research to find acceptable solutions to a number of fishery production, marketing and policy issues affecting the structure and economic well-being of the United States fisheries industry and develop an appropriate outreach program to transfer this information to the industry, consumers, and public policy makers. The fiscal year 1992 grants support research through September 1993. The two universities have submitted fiscal year 1993 grant proposals. The Oregon State University proposal is being reviewed. The grant for the University of Rhode Island has been awarded and supports research through February 1994

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992 and the appropriation for fiscal years 1992 and 1993 is $340,000 per year. A total of $680,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research program is carried out at the University of Rhode Island and Oregon State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Oregon State University has completed work on consumer preferences for pen-reared and high-seas captured salmon and an analysis of regulatory policies and industry strategies on the Pacific Whiting and Pacific Halibut fisheries. Work is underway on research to determine the relationship between market structure and seafood prices, an analysis of the implications of fishery management on trade and trade policies, and demand analysis for various seafood products. Rhode Island has completed studies on the demand and pricing of salmon in Japanese markets, developed models for price forecasting of fish products, and several studies on seafood quality and safety. Additional studies are planned or underway on market assessments for fish products, market structure, consumer perceptions of seafoods, and fishery management and market implications. The universities have developed a joint publication series to disseminate results to the industry, policy makers and the public.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The agreement under which this research is being conducted terminates in 1997.

FLORICULTURE, HAWAII

Mr. DURBIN. Please provide a description of the work that has been done under the floriculture program to date and the period of the existing contract.

Dr. JORDAN. The research program is continuing to search for new ways of producing disease and insect free cut flowers and foliage that have high quality for export markets. Research is being conducted on various aspects of disease control including breeding using standard techniques and genetic engineering, and developing pest management programs for anthurium blight and quarantine regulations. The fiscal year 1992 grant supports research through September 1993. The fiscal year 1993 grant has been received and is being processed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $300,000; fiscal years 1990, 1991, 1992, and 1993, $296,000 per year. A total of $1,484,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at University of Hawaii.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Research to date has shown that several new types of postharvest insect treatments are promising; new varieties of anthurium resistant to blight are being developed; and that by restricting nitrogen, growers can reduce anthurium diseases.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. It is anticipated that work may be completed in fiscal year 1995.

FOOD AND AGRICULTURE POLICY INSTITUTE, IOWA AND MISSOURI

Mr. DURBIN. Please provide a description of the work that has been done at the Food and Agriculture Policy Institute at Iowa State University and the University of Missouri and the period of the existing contract.

Dr. JORDAN. The Food and Agriculture Policy Research Institute—FAPRI—was established by Iowa State University and the University of Missouri, Columbia, in 1984. The purpose of the institute is to conduct comprehensive analyses and disseminate information on the sector impacts of United States food, agricultural, and trade policies.

Iowa State conducts research on the economic interrelationships within and between domestic and foreign food and agricultural markets from the farm gate to market destinations; develops and maintains data bases and analytical support systems to facilitate the analysis of agricultural and trade policy issues; and evaluates the impacts of United States and foreign commodity supply, demand, and public policy programs on agricultural trade.

The University of Missouri maintains a comprehensive analytical modeling system of the United States food and agricultural sector to evaluate near- and long-term economic implications of alternative farm policies for the basic commodities. The system is capable of providing economic information on impacts of farm policies on farm prices, income, output, program costs and means to enhance the management of farm programs at the national level. The fiscal

year 1992 grant to Iowa State University supports research through June 1993. The 1992 grant to the University of Missouri supports research through March 1993. The fiscal year 1993 proposals have been received by CSRS and are being reviewed.

Mr. DURBIN. how long has the work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1984–1985, $450,000 per year; fiscal years 1986–1987, $357,000 per year; fiscal year 1988, $425,000; fiscal year 1989, $463,000; fiscal year 1990, $714,000; and fiscal years 1991, 1992, and 1993 $750,000 per year. The total amount appropriated is $5,466,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The program is carried out at the Center for Agriculture and Rural Development, Iowa State University and Center for National Food and Agricultural Policy, University of Missouri.

Mr. DURBIN. What has been accomplished to date, and what work remains to be done?

Dr. JORDAN. Both institutions maintain large econometric models and current data set to analyze farm and trade policy alternatives and the impacts of various programs on the several sectors of the agricultural economy. During the past year, FAPRI completed studies of the policy implications to farmers, consumers and government of provisions contained in the Food, Agriculture, Conservation, and Trade Act of 1990. Studies included an update on the United States agricultural outlook, outlook for United States meat exports, analysis of the Dunkel Text on agriculture, identification of major agricultural issues for the nineties and agricultural transformation in the Baltics.

Future work includes updating data sets and models to analyze the implications of the 1990 Farm Bill and proposed amendments, alternative trade agreement impacts, assessment of the economic transformation in Eastern Europe and New Independent States, and conceptualization of and linkage of a resource and environment and food-nutrition baselines with the existing agricultural baseline for broader policy analysis purposes.

Mr. DURBIN. When do the principal researchers carrying our this work anticipate that the work will be completed?

Dr. JORDAN. This phase of the project will be completed with enactment of the 1995 Farm Bill and pending trade legislation.

FOOD IRRADIATION, IOWA

Mr. DURBIN. Please provide a description of the work that has been done under the food irradiation program to date and the period of the existing contract.

Dr. JORDAN. There have been several delays in the start-up of the accelerator due to modifications that needed to be made by the manufacturer. Final training on operation, maintenance, and dosimetry procedures has been carried out. Professional contacts have continued with scientists from the USDA, Canada, Poland, China, Vietnam, and other universities in the United States. Research projects are planned that relate principally to the elimina-

tion of pathogenic bacteria and viruses from meat products held under various conditions and to the knowledge and acceptance of irradiated foods by consumers. The fiscal year 1992 grant supports work through June 1993. The fiscal year 1993 proposal has been received, is being reviewed and will support research through June 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991 and the appropriation for fiscal year 1991 was $100,000. The appropriations for fiscal years 1992 and 1993 were $237,000 per year. A total of $574.000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Iowa State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The International Atomic Energy Workshop on Food Irradiation was held at Iowa State University in August, 1992 with over 30 participants from various foreign countries. A visiting scientist from Poland is currently at the University to work on the quality of irradiated meats. Studies on the effect of environmental stressors on survival and virulence of various foodborne pathogens in fresh meat have been conducted.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that the project will be completed in fiscal year 1995.

FOOD MARKETING POLICY CENTER, CONNECTICUT

Mr. DURBIN. Please provide a description of the work that has been done under the Food Marketing Policy Center program to date and the period of the existing contract.

Dr. JORDAN. The Food Marketing Policy Center was established in 1988 at the University of Connecticut at Storrs. The Center conducts interdisciplinary research on food and agricultural marketing and related public policy issues. Major studies have been completed on the economics of food safety, food industry competitive strategies, United States broiler industry, and strategic alternatives for agricultural cooperatives. The research program objective is to improve market performance for the benefit of farmers and consumers.

The fiscal year 1992 grant supports the research program through August 1994. The fiscal year 1993 proposal has been submitted and is being reviewed by CSRS.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1988, $150,000; fiscal year 1989, $285,000; fiscal year 1990, $373,000; and fiscal years 1991, 1992, and 1993, $393,000 per year. A total of $1,987,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. The research is being carried out by the Connecticut Agricultural Experiment Station at Storrs.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The Center's research program is to identify marketing problems and assess alternatives that would improve the performance of the United States agricultural and food marketing sector and conduct research in conjunction with the Hatch regional research project NE-165, "Private Strategies, Public Policies and Food Systems Performance."

The Center has completed a number of studies on marketing including an assessment of food retailing mergers and competition, evaluation of state dairy regulations, branded product marketing strategies, supermarket chain entry, oligopsony in agricultural markets, impact of agricultural cooperatives on food processor market performance; developed analytical methods to assess market performance; and sponsored several workshops on industrial organization and food safety.

The Center has implemented its comphrensive research plan with research targeted at three problem areas. They are factors shaping decisions by food firms and the consequent effects, impact assessment of public intervention on firm food safety and quality strategies, and analysis of public policies affecting competition in food markets. The Center cooperates closely with the University of Massachusetts in carrying out the research program. Studies are underway to analyze the competitiveness strategies of cooperatives; restructuring strategies dominance, and performance of food processors and retailers, food industry advertising and effectiveness, demographic analysis of food contamination, impacts of food regulation preemption, use of nutritional labels, firm response to food safety and nutrition regulations, and basic research on oligopoly theory.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. Work planned under this phase of the project is scheduled for completion with expiration of the NE-165 regional research project in 1997.

FOOD PROCESSING CENTER, NEBRASKA

Mr. DURBIN. Please provide a description of the work that has been done under the Food Processing Center program to date and the period of the existing contract.

Dr. JORDAN. The University of Nebraska Food Processing Center has conducted technical assessments on a host of products and provided assistance to numerous small and mid-sized food processors and entrepreneurs. In addition, three research projects supported during the first year included a determination of the conditions which contribute to or allow mold invasion of stored popcorn including popcorn-on-the-ear, food safety assessment of specialty bakery items, and improving the quality of foods containing dry beans. The fiscal year 1992 grant supports research through April 1993. The fiscal year 1993 proposal has been received, is being reviewed and will support research through June 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992 and the appropriation for fiscal years 1992 and 1993 was $50,000 per year. A total of $100,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of Nebraska.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Technological evaluations were conducted for 34 individuals or companies interested in developing new food processing businesses. Microbiological analyses were conducted for 4 mid-sized companies, including extensive shelf-life assessments for one of these companies. Nutritional analyses were conducted for 12 small to mid-sized Nebraska food companies who were preparing for the new nutritional labeling regulations.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that the fiscal year 1993 appropriation will support projects that will be completed in 1994.

FOOD SYSTEMS RESEARCH GROUP, WISCONSIN

Mr. DURBIN. Please provide a description of the work that has been done under the Food Systems Research Group to date and the period of the existing contract?

Dr. JORDAN. The Group conducts research on issues affecting the organization and competitiveness of the United States food system. Research objectives are to analyze factors affecting the competitiveness of United States food industries and markets. The factors include new technologies, market structure, and government policies and programs. Studies have been completed on feed cattle and hog pricing as influenced by changing industry structure, causes of structural change in the flour milling, soybean oil milling, wet corn milling, cottonseed milling, beef packing, and broiler processing industries. The fiscal year 1992 grant supports this research through August 1996. The fiscal year 1993 proposal has been submitted and is being reviewed.

Mr. DURBIN. How long has this work been underway, and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal years 1976–1981, $150,000 per year, fiscal years 1982–1985, $156,000 per year; fiscal years 1986–1989, $148,000 per year; fiscal year 1990, $219,000, and fiscal years 1991, 1992, and 1993, $261,000 per year. A total of $3,118,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. The grant supports a core research group at the University of Wisconsin, Madison.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The Food Systems Research Group has completed numerous studies on the economic structure and performance issues about the United States food manufacturing and distribution system. The Group conducts basic research on market theories; effects of mergers, new technologies, and firm conduct on industry

structure and organization; factors affecting industry prices, profits, efficiency and progressiveness; and impact of public policies and regulations on food system organization and performance. Current research in progress includes an assessment of competition in the beef and hog industry, legal-economic analysis of competition in the procurement of cheese at the National Cheese Exchange, competition in grocery market retailing, and completion of an analysis on the structure on food manufacturing industry.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The Food Systems Research Group anticipates that it can complete the existing plan-of-work by 1997 with some individual projects completed prior to that date.

FORESTRY MARKETING, VERMONT AND NEW HAMPSHIRE

Mr. DURBIN. Please provide a description of the work that has been done under the forestry marketing program to date and the period of the existing contract.

Dr. JORDAN. The purpose of this program is to support research to assess marketing problems and identify potential solutions affecting the forest products industry in Vermont and New Hampshire. The investigators have developed and implemented a plan-of-work. The first stage encompasses establishment of the value and potential of the Northern Forest resource base and identifying market potentials based on future opportunities. The fiscal year 1992 appropriation supports research through March 1993. CSRS has requested a grant proposal for fiscal year 1993 funds.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992. The appropriation for fiscal years 1992 and 1993 was $50,000. A total of $100,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. The research program is carried out by the University of Vermont.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. A survey of forest product firms has been initiated.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The investigators anticipate that work will be completed in fiscal year 1994.

GLOBAL CHANGE

Mr. DURBIN. Please provide a description of the work that has been done under the global change program to date and the period of the existing contract.

Dr. JORDAN. Ultraviolet-B, UV–B, radiation is that in the lower part of the solar spectrum. Many forms of living organisms may be harmed by excessive exposure to UV–B radiation. In fact, Agriculture may face serious problems due to the damaging effects of UV–B radiation on crops, animals and forests. It is also known that the ozone layer in the stratosphere reduces the amount of this radiation reaching the earth's surface. Particulate matter in the atmos-

phere also blocks some of this earthbound radiation, thus providing some protection from UV–B. People, plants, and animals may be at increased risk from increased levels of UV–B radiation as a result of manmade chemicals partially destroying the stratospheric ozone layer. Since the United States did not have a UV–B monitoring network the status of UV–B radiation in the nation was not known. Several meetings with experts from other Federal agencies, universities and private industry have been held to coordinate this network. A coordinating committee for UV–B research is being established under the Long-Term Observation Working Group of the Subcommittee on Global Change Research. CSRS is in the process of establishing a network for monitoring UV–B radiation that will meet the needs of the science community of the United States, and will be compatible with measurements made in other parts of the world. The fiscal year 1992 grant supports research through June 1993. The grant proposal for fiscal year 1993 has been requested. Funds appropriated in fiscal year 1993 are going to be used for network operational expansion, data analysis and acquisition, and procurement of instruments for the monitoring network. These funds may be used to support research through 1997.

This grant is part of a government-wide initiative. The research is closely coordinated with other Federal agencies actively involved in Global Change research.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992 and the appropriation for fiscal years 1992 and 1993 was $2,000,000 per year. A total of $4,000,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. When established the network will include many parts of the country. Colorado State University is managing the operating network. The first research instrument will be installed in cooperation with the Department of Energy Atmospheric Radiation Measurements field site at Ponca City, Oklahoma. Other research sites are still under discussion. In addition, thirty climatological sites are planned for the U.S., including Hawaii, Alaska, and Puerto Rico to provide broad geographical coverage. Full implementation of these sites will be dependent on the current efforts to develop accurate low-cost instrumentation.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Under the National Research Initiative Competitive Grants Program a grant was awarded to design and build an advanced spectroradiometer to make precise measurements in the UV–B range. The first two of these instruments are being calibrated and characterized by the National Institute of Standards and Technology—NIST. Installation in the field is expected to take place this summer. Some less expensive and accurate instruments of the broad-band type are being evaluated by NIST. These are to be used in the network this year to provide experience in operating the network. Concurrently, additional advanced research spectroradiometers are to be built during the next two years and lower cost accurate instruments are being developed to replace the broadband meters. Six spectroradiometers of the filter wheel type are

being built for the UV–B monitoring network by the Smithsonian Institution, where they were developed. The broad-band and filter wheel instruments, while not as accurate as the research instruments, should provide UV–B trend indications.

These Special Research Grant funds are being used for a national network for monitoring UV–B radiation which is being initiated with plans for 30 sites across the country, including remote areas. Monitoring will begin when development of advanced spectroradiometers is complete.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. It is anticipated that this network will be an ongoing need as with climatological measurements. Over the next several years these measurements will provide information as to the nature and seriousness of UV–B radiation in the United States and how it relates to the radiation elsewhere in the world.

GRASSHOPPER BIOCONTROL, NORTH DAKOTA

Mr. DURBIN. Please provide a description of the work that has been done under the grasshopper biocontrol program to date and the period of the existing contract.

Dr. JORDAN. The research to date has developed a way to produce and store a microbial biological control agent for control of pest grasshoppers. This research also has developed formulation and application methods. The fiscal year 1992 grant supports research through March 1993. The fiscal 1993 grant proposal has been received and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $69,000; fiscal year 1990, $71,000; fiscal year 1991, $73,000; and fiscal years 1992 and 1993, $75,000 per year. A total of $363,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at North Dakota State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Research at North Dakota State University has shown that a disease organism of grasshoppers can be used to control pest grasshoppers. Methods have been developed to formulate, store and deliver the pathogen in a commercially available bait. Research is continuing to develop the potency and pest target specificity of the product.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The current proposal indicates that 18 additional months are necessary to complete the objectives of the proposal.

GREAT PLAINS AGRICULTURE POLICY CENTER, KANSAS AND OKLAHOMA

Mr. DURBIN. Please provide a description of the work that has been done under the Great Plains Agriculture Policy Center program to date and the period of the existing contract.

Dr. JORDAN. The purpose of this program is to conduct research on the impact of Federal farm policies on agriculture and rural economic development in the Great Plains States. Policies to be analyzed include planting flexibility, post-Conservation Reserve Program land-use, conservation compliance, and wetlands. The investigators have implemented the first phase of organizing collaborators, collecting data, and developing the analytical methods. The 1992 grants support research through April 1993. Oklahoma State University has submitted its fiscal year 1993 proposal which is being reviewed, and Kansas State University has been requested to submit its proposal.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992. The appropriation for fiscal years 1992 and 1993 is $100,000 per year. A total of $200,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. The research program is carried out at Kansas State University and Oklahoma State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Data sets have been compiled and validated and empirical model development is in progress.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The agreement under which this research is being conducted terminates in 1997.

HUMAN NUTRITION, IOWA

Mr. DURBIN. Please provide a description of the work that has been done under the human nutrition program to date and the period of the existing contract.

Dr. JORDAN. The mission of the Center for Designing Foods to Improve Nutrition at Iowa State University is to promote nutritional assurance and health maintenance. Research efforts are focused on development of new foods to improve nutritional quality; to identify naturally occurring food components—protectants, toxicants and non-nutritive factors—which may improve nutritional status and decrease health risks; and to develop the means to modify consumer food selection. The ongoing research program involves 12 projects with nearly 40 senior researchers from multiple colleges and departments. The fiscal year 1992 grant supports research through March 1993. CSRS has requested that the university submit a fiscal year 1993 grant proposal which is now being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991 and the appropriation for fiscal year 1991 was $300,000. The fiscal years 1992 and 1993 appropriation was $500,000 per year. A total of $1,300,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. Research is being conducted at the Center for Designing Foods to Improve Nutrition, Iowa State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. A major effort was made to alter the fat content and composition of both beef and pork. Researchers were able to increase the unsaturated fatty acid content of beef by adding ground soybeans to feed. Administration of porcine somatotropin yielded 46 percent leaner pork loins yet tenderness, juiciness and flavor were retained. In another project, methods were developed to extract and purify natural antioxidants from oats. The extracts proved functional in stabilizing cooking oils. Studies using a national phone survey demonstrated that diet and health attitudes affected consumption of dairy foods. Thus, informational messages should be directed to improve consumer attitudes to effect behavioral changes.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1995.

HUMAN NUTRITION, LOUISIANA

Mr. DURBIN. Please provide a description of the work that has been done under the human nutrition program to date and the period of the existing contract.

Dr. JORDAN. A series of studies on the differences in dietary fats is under active investigation at the Pennington Biomedical Research Center at Louisiana State University. This project consists of three different groups of studies. The first project deals with the effects of different diets on the oxidation of individual fatty acids which are found in foods or made during preparation of fats for human consumption. The second project is examining the effect of raising or lowering the amount of fat in the diet on the food choices and metabolic changes that people make. The final project is testing the effects of increasing the amount of fish oil in the diet on the risks for heart disease. The fiscal year 1992 grant supports research through June 1993. CSRS has requested that the university submit a fiscal year 1993 grant proposal which is now being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991 and the appropriation for fiscal years 1991, 1992, and 1993 was $800,000 per year. A total of $2,400,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research will be conducted at the Pennington Biomedical Center, Louisiana State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. To date oxidation of seven different fatty acids has been studied in six normal weight men and one woman eating the standard American diet. Additional studies in women eating the standard American diet and in both men and women eating a 20 percent fat diet are underway and will be completed shortly. A variety of new foods have been prepared substituting the usual fats with an indigestible fat. The effect of substituting food with indi-

gestible fat on the intake of foods and on metabolism are underway. Finally, the diet containing fish oil supplements has been prepared and subjects will be recruited as soon as the protocol design is approved. The projects underway are progressing satisfactorily.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1995.

HUMAN NUTRITION, NEW YORK

Mr. DURBIN. Please provide a description of the work that has been done under the human nutrition program to date and the period of the existing contract.

Dr. JORDAN. The researchers reoriented their objectives to address the nutritional roles of plant foods in the food system. Attention is being given to the potential beneficial components in plant foods; the implications of an increased reliance on plant foods by nutritionally vulnerable groups dependent upon high nutrient densities in their diet, and the issues relevant to the successful implementation of current recommendations that rely on increased consumption of plant foods. Emphasis is being given to assuring effective communication among professionals with interests in each of these areas. The fiscal year 1992 grant supports research through September 1993. CSRS has requested that the university submit a fiscal year 1993 grant proposal.

Mr. DURBIN. How long has this work been underway, and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $450,000; fiscal years 1990 and 1991, $556,000 per year; fiscal years 1992 and 1993, $735,000 per year. A total of $3,032,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Cornell University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The advanced stable isotope laboratory is supporting activities in two areas related to the role of plant foods in nutrition. The first is the study of essential fatty acids that are critical to the development of the brain and eyes of infants. New analytical techniques have permitted the design of studies which trace the fate of these products in a primate model. The second is the metabolism of beta-carotene. Advances in their laboratory permit, for the first time, a tracer study of this compound in amounts typically present in a medium sized carrot. Faculty have also initiated work designed to describe the health linkages in the food system, and to identify the information that is most amenable to the transfer to industry and consumers. Nutrition scientists and agricultural economists are collaboratively examining the implications of an increased reliance on plant foods on our agricultural and food system, on consumers with limited resources, and on food assistance programs sponsored by the federal government.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in 1994.

IMPROVED DAIRY MANAGEMENT PRACTICES, PENNSYLVANIA

Mr. DURBIN. Please provide a description of the work that has been done under the improved dairy management practices program to date and the period of the existing contract.

Dr. JORDAN. The research focuses on developing methods to help dairy farmers in the adoption of new technology and management practices that will lead to improved dairy farm profitability. The fiscal year 1992 grant supports research through May 1994. The fiscal year 1993 proposal has been received from the University and is currently undergoing review by CSRS.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992 and the appropriation for fiscal years 1992 and 1993 was $335,000 per year. A total of $670,000 has been appropriated. CSRS has requested the University to submit a general proposal for fiscal year 1993 which has been received and is currently under review.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Pennsylvania State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Research currently underway includes the assessment of economic, technological, and resource conditions on Pennsylvania dairy farms using survey analysis. An analysis of the effect of management ability on dairy farm profitability and evaluation of management education programs are in progress.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work will be completed in June 1995.

INTEGRATED PEST MANAGEMENT

Mr. DURBIN. Please provide a description of the work that has been done under the integrated pest management program to date and the period of the existing contract.

Dr. JORDAN. Research and extension programs in IPM since approximately 1978 have placed emphasis on procedures to monitor pests, identify thresholds, and reduce the amount of pesticides used in agricultural production systems through cooperative efforts of research and extension. Today insecticide and fungicide use has been reduced by approximately 50 percent in most production systems from former levels of calendar date spray applications. In addition, research has focused on the development of alternative technologies to chemical pesticides for managing pest populations and these technologies are being implemented through collaborative extension research programs for improved profitability and environmental safety. In fiscal year 1992 research grants emphasized research on the following priority areas: biological control; cultural control; pest management integration and pest movement and dis-

persal, host resistance, resistance management, pest biology, and improved pest monitoring and thresholds.

All four IPM regions have submitted their fiscal year 1993 request for proposals in areas identified by national working groups and managed peer review panels to score and rank the top proposals. CSRS will complete proposal processing in March in time for the 1993 field season. Grants awarded in 1993 will support research for two or three years. A pilot research/extension request for proposals has been developed in the North Central Region for projects to be funded cooperatively between ES and CSRS in 1993.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated to CSRS as follows: fiscal year 1981, $1,500,000; fiscal years 1982 through 1985, $3,091,000 per year; fiscal years 1986 through 1989, $2,940,000; fiscal year 1990, $2,903,000; fiscal year 1991, $4,000,000; and fiscal years 1992 and 1993, $4,457,000. A total of $41,441,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. This work is being carried out in practically all of the State Agricultural Experiment Stations. This research grant program has leveraged additional state and federal funds in identified priority areas.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The Western Region developed a 1992 accomplishment report and the Southern and North Central regions are developing similar documentation. The following accomplishments and research to be supported in 1993 in the Northeastern region demonstrate how the program builds on past accomplishments and implementation program needs: Research at the Maryland Experiment Station has demonstrated that oat and alfalfa intercropping aids in the establishment of spring-seeded alfalfa. The intercrop provides weed management, by growing quickly, and has additional advantages including reduced soil erosion, improved soil conditions, and reduced insect impact. Oats in the alfalfa-oat intercrop repels leafhoppers and negates the need for insecticides which disrupt previously developed biological control systems for the alfalfa weevil. In addition, researchers at Pennsylvania and New York are developing biological control with entomopathogenic nematodes for alfalfa snout beetle, a exotic pest rapidly spreading in Western New York, and the clover root curculio, which has been shown by research in Vermont to cause deep feeding wounds. Correlations are evident between root damage, reduced alfalfa root reserves for over wintering hardiness, increased root diseases, and reductions in above ground plant growth. Root and crown rots caused by species of the fungal genus *Phytophthora* are serious and relatively common diseases on a wide range of plants cultivated throughout the Northeast, including forage crops like alfalfa. New York researchers have discovered strains of *Gliocladium virens* that control *Phytophthora* root rots of apple, raspberry, and soybeans in greenhouse trials and have associated this control with production of an antibiotic, gliotoxin. A commercial firm, LiphaTech in Milwaukee, Wisconsin has developed technology for producing a granular formulation of these and other stains of *Gliocladium* and

Trichoderma spp. Field trials conducted for control of *Phytophthora* root rots using *Gliocladium virens* with cultural, and chemical methods indicated that best results were obtained when these components were integrated. Considerable progress and additional research remains to be done to provide alternative IPM management systems for second generation agriculture and urban interface production in the Northeast and other sections of the country.

The New York Agricultural Experiment Station is pursuing the use of green manure crops to manage soilborne pathogens and nematodes in potatoes. Identified, volatile chemicals from green manure crops have been demonstrated to disrupt soilborne pathogens and nematodes. This work is particularly important because the environmental problems and future availability of soil fumigants is a paramount issue.

Vegetables are considered by many not to be amenable for production without extensive pesticides. Past research accomplishments at the New York Experiment Station on pest sampling, threshold values, cultural control and host resistance have reduced pesticide use by 50%. For example, present commercial management of thrips on cabbage relies on host plant resistance. Current research to be funded in 1993, building on past accomplishments, will develop an insect management plan which will utilize parasitism, predation, disease, pheromone disruption, and host plant resistance, to produce an economically viable and cosmetically acceptable crucifer crop without routine use of insecticides.

Grapes, an important crop for fresh market and the Eastern wine industry is another system that can now largely be grown without insecticides due to management of the grape berry moth with pheromone that disrupt moth mating. However, when pheromone replaced insecticide applications, a secondary pest, the grape leafhopper caused economic damage one out of three years. Current research is improving the biological control of grape leafhoppers with a parasite that is effective in Europe and California. Biological control of grape leafhopper is now possible with the absence of insecticides in the grape system.

Two-years of research in Maine have demonstrated potential for the development of a weed management strategy for potatoes based upon the integration of weed suppressive rotation crops, tillage practices, and conservation of insect weed seed predators. Bioeconomic models for weed management in potatoes comparing weed growth in stands of oats, berseem clover, barley, and a green manure mixture composed of oats, field pea, berseem clover, and hairy vetch. These studies indicate that large differences exist in weed growth in potatoes in relation to crops grown in rotation with potatoes; choice of rotation crop and tillage regime can strongly influence densities of germinable weed seeds in the soil; and the insect seed predator, *Harpalus rufipes,* constitutes greater than 60% of the local carabid fauna and can consume considerable quantities of weed seeds in potato fields. Field studies with caged populations of *Harpalus rufipes* indicated weed seed predation rates of 47–76%.

A fair amount of research has been conducted in NY, MI, OR, MA, etc. on the use of predacious mites to manage European red mite in apple orchards. The two predacious mites *Amblyseius falla-*

cis and *Typhlodromus pyri* are very different in their biology and dynamics. These differences determine the conditions under which they are effective as biological control agents and affect ways in which they might be managed. Current research at New York will study key factors to enhance the capability to utilize and manage predacious mites for European mite control under Northeast growing conditions.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The IPM program involves research on biological systems that are ever changing and presenting new challenges to agriculture. There is a high priority for continuation of research since IPM provides the science basis for addressing environmental issues associated with pesticide use.

INTEGRATED PRODUCTION SYSTEMS, OKLAHOMA

Mr. DURBIN. Please provide a description of the work that has been done under the integrated production systems program to date and the period of the existing contract.

Dr. JORDAN. Research has been conducted on mulches with strawberries and intercropping of cabbage with rye. New cultural and management practices are being developed for watermelons and blackberries which are expected to result in further increases in high quality, high yielding cultivars. The fiscal year 1992 grant supports research through June 1994. The fiscal year 1993 project is being reviewed and will support research through June 1995.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1984, $200,000; fiscal year 1985, $250,000; fiscal year 1986, $238,000; fiscal years 1987–1989, $188,000 per year; fiscal years 1990–1991, $186,000 per year; fiscal year 1992, $193,000; fiscal year 1993, $190,000. A total of $2,007,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research is being conducted at the Oklahoma State Agricultural Experiment Station.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Research results indicate that strawberry mulches can be detrimental to strawberries grown in southern Oklahoma versus central and northern Oklahoma which experience much colder winter temperatures. Interplanting of rye with cabbage has resulted in significantly fewer insects such as cabbage loopers, aphids, and thrips. Economic analyses have shown that farmers receive a greater monetary return by the use of new cultural practices and intercropping of species that are compatible with each other.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that this work will be completed in fiscal year 1997.

IOWA BIOTECHNOLOGY CONSORTIUM

Mr. DURBIN. Please provide a description of the work that has been done under the Iowa Biotechnology Consortium program to date and the period of the existing contract.

Dr. JORDAN. The University of Iowa, together with the City of Cedar Rapids and Iowa State University, are conducting a joint research and demonstration project to develop and test methods to turn fermentation by-products into useful new products. The intention is to reduce the burden of waste products from bioprocessing plants upon municipal waste management systems, while at the same time increasing opportunities to develop commercially viable products. The specific aims of the Biotechnology By-products Consortium—BBC—involve a general model approach to the evaluation of how to handle the streams, what is economically viable for isolation and by what processes, and finally whether it is more appropriate to use the material for land application, livestock feed or anaerobic fermentation to give alternative energy sources. The 1992 grant supports research through March 1994. The 1993 grant proposals has been received and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal years 1989, $1,225,000; fiscal year 1990, $1,593,000; fiscal year 1991, $1,756,000; fiscal year 1992, $1,953,000; fiscal year 1993, $2,000,000. A total of $8,527,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of Iowa and Iowa State University, in collaboration with the City of Cedar Rapids.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The Consortium has made significant achievements in its work objectives. The Third International Symposium on "By-products in Biotechnology: An Untapped Resource" was held in Iowa City, Iowa, May 27–29 1992 and a symposium was organized and held at the recent American Association for the Advancement of Science meetings. The Consortium is reaching out to establish a network of researchers to assist them in finding uses for the by-product streams of concentrated steepwater, and methods to concentrate by-products for industrial uses. The Consortium is also making good progress in evaluating profitable uses of fats and carbohydrates through bioconversion, biocatalysis membrane concentration, and bioseparation. Another avenue of research has shown that land application of waste streams has considerable savings and benefits for crop production. Bioprocesses have been studied for economic significance and this information is being used to establish profitable technologies.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The Consortium work plan calls for completion of all research by 1994.

LIVESTOCK AND DAIRY POLICY, NEW YORK AND TEXAS

Mr. DURBIN. Please provide a description of the work that has been done under the livestock and dairy policy program to date and the period of the existing contract.

Dr. JORDAN. The purpose of this grant is to assess the possible impacts of various macroeconomic, farm and rangeland public policies; new technologies; and trade agreements on the United States livestock, poultry and dairy sectors. Both institutions conduct analyses of policies on these sectors and disseminate the information to policy makers, farmers, and agribusinessmen. The fiscal year 1992 grant to Texas A&M University supported the livestock research program through December 1992. The fiscal year 1992 grant to Cornell University supports the dairy policy research program through September 1993. Both universities have submitted their fiscal year 1993 grant proposals which are being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $450,000; fiscal year 1990, $518,000; and fiscal years 1991, 1992, and 1993, $525,000 per year. A total of $2,543,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. The research is being conducted at Cornell University and Texas A&M University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The purpose of the research program is to analyze the impacts of tax and monetary policies, farm policies including dairy, trade agreements, and new technologies on the United States dairy, livestock, and poultry sectors. Both institutions have successfully implemented their on-going research programs. Texas A&M is analyzing impacts of the Food, Agriculture, Conservation and Trade Act of 1990, possible amendments likely to be considered in the 1995 Farm Bill, rangeland management proposals, and trade agreements. Projections are made of supplies, prices, and farm receipts. Results are distributed throughout the United States to farmers, industry, and public policy makers by use of publications, public appearances, and workshops. Both institutions are collaborating in the development of more comprehensive livestock and dairy sector models to analyze farm policies and cost of farm programs. Cornell University collaborates with Texas A&M in the development of these models and outreach programs.

Cornell University is conducting studies on the impacts of the North American Free Trade Agreement and General Agreement on Tariffs and Trade and trade liberalization on the United States dairy industry, milk price formation and discovery, and how dairy revenues for different sized farms are impacted by alternative policies. Work is completed on multiple component pricing, alternatives to the Minnesota-Wisconsin base point for pricing, and evaluating performance of United States and Canadian dairy farms. Cornell prepares numerous dairy extension publications on its research for distribution throughout the United States by the Cooperative Extension Service.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. This project will be completed when the 1995 Farm Bill and trade legislation are enacted.

LOWBUSH BLUEBERRY RESEARCH, MAINE

Mr. DURBIN. Please provide a description of the work that has been done under the lowbush blueberry research program to date and the period of the existing contract.

Dr. JORDAN. Interdisciplinary research is being conducted on many aspects of lowbush blueberry culture and marketing including irrigation, fertilization, postharvest methodology, pests and fruit bud cold hardiness. The fiscal year 1992 grant supports research through September 1993. The fiscal year 1993 grant proposal has been received and is being processed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1990, $170,000; fiscal year 1991, $202,000; fiscal years 1992 and 1993, $185,000 per year. A total of $742,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of Maine.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Research to date indicates that boron and phosphorus can increase yields; potassium may increase winter hardiness of lowbush blueberry plants; alfalfa leafcutter bees can improve blueberries; and chlorinated wash water reduces postharvest fruit spoilage.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that the work may be completed in fiscal year 1995.

LOW-INPUT AGRICULTURE, MINNESOTA

Mr. DURBIN. Please provide a description of the work that has been done under the low-input agriculture project and the period of the existing contract.

Dr. JORDAN. This project is testing the hypothesis that the soil-specific farming concept or variable soil management as related to soil condition can maximize farm profitability and minimize environmental damage while lowering or optimizing inputs. The project has tested the use of a variable-rate air spreader for dry fertilizer and impregnated herbicides, as well as a variable rate spreader for anhydrous ammonia and denitrification inhibitor.

The soil productivity effects of changing seed population is being assessed as a means of lowering purchased inputs for the corn-soybean system of the western Corn Belt. A variable rate tillage system is being studied to develop reduced tillage practices and, as a result, lower energy inputs on the farm when contributing to wind and water erosion control.

The fiscal year 1992 grant supports this research through May 1993. The research proposal for fiscal year 1993 is being reviewed by the Cooperative State Research Service.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal years 1988 and 1989, $100,000 per year; fiscal year 1990, $148,000; fiscal year 1991, $174,000; and fiscal years 1992 and 1993, $230,000. A total of $982,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research is being conducted by the Department of Soil Science at the Minnesota Agricultural Experiment Station, University of Minnesota. The work is being done both in the Soil Science laboratories and at field sites on various Experiment Station research branches and on private farms in Minnesota.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Results from studies of the benefits of soil-specific applications of dry fertilizer impregnated with herbicide at field locations in Southwestern Minnesota, indicate a greater net return of more than $20 and $10 per acre, respectively, for soil-specific treatments with variable application rates, when compared to the conventional uniform treatment rate. A portable computer-based system for application of anhydrous ammonia by soil condition, developed in 1990, shows benefits greater than $15 per acre for application rates based on soil types and soil fertility levels over the conventional uniform application rates. In 1991, this system was modified to control application of anhydrous ammonia and nitrification inhibitors by soil conditions. Preliminary results indicate high corn yield variability in the check treatment, confirming the potential benefit of soil specific management.

A tillage implement has been modified, with matching funds from two equipment companies, to control soil surface residue coverage by soil condition.

In 1992, the variable rate anhydrous ammonia management had a $10 net return greater than the conventional management. The soil-specific tillage system varied the amount of corn residue left at the soil surface from 30 to 44 percent according to equipment settings. This means that the system can almost simulate a moldboard plow and a chisel plow on-the-go and leave a residue cover appropriate to soil conditions. The soil-specific seeding system, modified with matching funds from one equipment company, varied successfully the corn population according to the target rates: 38,000; 32,000; 26,000; and 20,000 plants per acre.

Results of the study of the effect of soil-specific management on water quality indicate that in the period 1991–1992, runoff losses of the herbicide alachlor was lower for soil-specific management than conventional management at the research soil-landscape site.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. It is anticipated the work my be completed in fiscal year 1995.

MAPLE RESEARCH, VERMONT

Mr. DURBIN. Please provide a description of the work that has been done under the maple research program to date and the period of the existing contract.

Dr. JORDAN. The current focus of this research is titled "Nutrition and Vigor of Declining Maples Before and After Fertilization".

The beginning research in this series examined the water stress physiology of maple trees and was aimed at understanding the flow of water from the soil, through the tree and out the leaves. Acid rain interactions with maple leaves was investigated prior to the current work on nutrition. More work on root physiology will be planned to substantiate the hypothesis that tree root health may be the primary determinant of tree health in sugar maples. The fiscal year 1992 grant supports research through June, 1993. The fiscal year 1993 grant proposal has been received and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1985, $100,000; fiscal years 1986 and 1987, $95,000 per year, fiscal year 1988 and 1989, $100,000 per year; fiscal years 1990, 1991, 1992, and 1993, $99,000 per year. A total of $886,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. This research is being conducted at the Vermont Agricultural Experiment Station.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Analysis of sap collected recently showed no relationship between foliar nutrient status and sap sugar levels. Several characteristics of both declining and healthy maples in the study plots were monitored during the growing season. The only significant finding was that leaf nitrogen was higher in healthy sites where the maples were declining. Photosynthesis studies are showing significant differences between healthy and unhealthy trees uptake of carbon dioxide. However, the causes of this difference in photosynthesis have not be identified.

Mr. DURBIN. When do the principal researchers carrying out his work anticipate that the work will be completed?

Dr. JORDAN. The research planned for fiscal year 1993 is to relate the regeneration of maples on specific sites and the nutrient status of those sites.

MASSACHUSETTS BIOTECHNOLOGY

Mr. DURBIN. Please provide a description of the work that has been done under the Massachusetts Biotechnology Research Institute program to date and the period of the existing contract.

Dr. JORDAN. CSRS requested the Massachusetts Biotechnology Research Institute to submit a grant proposal that has been received and is now being reviewed for scientific merit. The Institute is proposing to enhance the commercial development of agricultural biotechnology innovations in Massachusetts through a centralized coordination of efforts, and to stimulate further innovations for future commercial activities. This will be done through four interconnected areas: technology evaluation and transfer; company formation/investment; education, training and public policy; and reinvestment in basic research. The proposal has been sent to five biotechnology scientists knowledgeable in the science as well as technology transfer to decide whether the proposed research during

this first year justifies the award or whether modifications to the proposal will be necessary.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant begins in fiscal year 1993 and the appropriation for fiscal year 1993 is $256,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research will be conducted at the Massachusetts Biotechnology Research Institute and at partner institutions not yet identified.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The plan is to identify emerging technologies that have commercial potential and then through the process of development and with the institute services, bring those discoveries to the market.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The principal investigator has indicated the project would extend for a five year period through fiscal year 1998.

MICHIGAN BIOTECHNOLOGY INSTITUTE

Mr. DURBIN. Please provide a description of the work that has been done under the Michigan Biotechnology Institute program to date and the period of the existing contract.

Dr. JORDAN. The objective of the Michigan Biotechnology Institute's research program is to develop bioprocessing technology to manufacture products from agricultural raw materials. In this context, bioprocessing may include a fermentation, an enzymatic step, chemical catalysis, or physical modification of agricultural raw materials. The fiscal year 1992 grant supports research through January 1993. The 1993 grant proposal has been received and is being reviewed.

Mr. DURBIN. How long has this work been under way and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $1,750,000; fiscal year 1990, $2,160,000; fiscal year 1991, $2,246,000; and fiscal years 1992 and 1993, $2,358,000 per year. A total of $10,872,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research is being conducted on the campus of Michigan State University at the Michigan Biotechnology Institute.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Michigan Biotechnology Institute has succeeded in developing a number of bioprocesses to produce chemicals and an anti-cancer drug, food ingredients, polymeric materials, and feeds in the four focus areas that make up the institute's overall program for bioprocessing of agricultural raw materials. The food ingredients include a no sodium or potassium salt substitute for which a US patent was filed on August 4, 1992. Michigan Biotechnology Institute has developed new formulations for bio-based solvents in natural cherry flavor, natural succinic-acid from corn by fermentation and dietary fibers from the modified corn bran. Polymeric materials include biodegradable starches that can be used in

injection molding and cast film extrusion and biodegradable zein products that can be used as coatings to paper, that can still be recycled. Michigan Biotechnology Institute has also been developing biocomposites that can be injection molded, such as materials using waste wood and pecan shells. Biocataylic processes include a demonstrated method for improved glucose manufacturing and thermal stable cellulose. Many of these products are being explored for commercial development through licensing agreements with industrial partners.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The Institute has reported specific milestones that they intend to accomplish within the five year period ending in fiscal year 1994. Michigan Biotechnology Institute has kept to that timetable and it's anticipated that they will be able to complete the work on schedule.

MIDWEST AGRICULTURAL PRODUCTS, IOWA

Mr. DURBIN. Please provide a description of the work that has been done under the midwest agricultural products program to date and the period of the existing contract.

Dr. JORDAN. The purpose of this grant is to conduct a program of applied research to improve the competitiveness and marketability of agricultural sector products produced in the Midwest and disseminate the research results to users. Programs have been initiated on trade and market analysis, agribusiness trade initiatives, and dissemination of research. The fiscal year 1992 grant supports research through April 1994. Iowa State University has submitted a fiscal year 1993 grant proposal and it is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992. The appropriation for fiscal years 1992 and 1993 is $700,000 per year. A total of $1,400,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. The research program is carried out by Iowa State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Research has been completed on meat marketing in the former Soviet Union states and Singapore, soybean product markets in Japan, an update on world food trade and United States agriculture, and an update on the General Agreement on Tariffs and Trade negotiations. A trade initiatives effort has been developed with the Baltic States and a research dissemination and workshop program organized.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The agreement under which this research is being conducted terminates in 1997.

MIDWEST PLANT BIOTECHNOLOGY CONSORTIUM

Mr. Durbin. Please provide a description of the work that has been done under the Midwest Plant Biotechnology Consortium program to date and the period of the existing contract.

Dr. Jordan. The purpose of the Midwest Plant Biotechnology Consortium is to foster and facilitate promising basic research investigations that will lead to industrial applications. Through the Midwest Plant Biotechnology Consortium, universities, Federal laboratories, and company collaborators conduct research in plant biotechnology in efforts to: utilize agricultural products as new sources of chemicals, pharmaceuticals, and energy; reduce the cost of agricultural production; improve utilization of existing crops; and develop safe environmental practices. The fiscal year 1992 grant supports research through April 1993. A grant proposal was requested for fiscal year 1993 and has been received and is being reviewed.

Mr. Durbin. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. Jordan. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $1,750,000; fiscal year 1990, $2,592,000; fiscal year 1991, $2,730,000; and fiscal years 1992 and 1993, $2,865,000 per year. A total of $12,802,000 has been appropriated.

Mr. Durbin. Where is this work being carried out?

Dr. Jordan. Research is being conducted by members of the consortium which is comprised of ten Land-Grant institutions and six associated universities located throughout the North Central States.

Mr. Durbin. What has been accomplished to date?

Dr. Jordan. The Consortium solicited through a mechanism of pre-proposals 43 full proposals that were then peer reviewed to identify 25 projects to be carried out at 13 participating universities. Ongoing projects have focused on the application of biotechnology tools for improving major U.S. agricultural crops using genetic transformation systems. Researchers funded through the Consortium have identified genes controlling protein biosynthesis, sources of resistance to disease and genetically conditioned factors contributing to crop yield. In addition, genomic mapping with corn has advanced scientific understanding of traits of agricultural importance.

Mr. Durbin. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. Jordan. The Consortium has indicated a five year work plan will be completed in FY 1994.

MILK SAFETY, PENNSYLVANIA

Mr. Durbin. Please provide a description of the work that has been done under the milk safety program to date and the period of the existing contract.

Dr. Jordan. Researchers have examined conditions under which food-borne pathogens such as *Listeria monocytogenes* and *Staphylococcus arrows* are inhibited and those under which they are likely to thrive. They have examined the level of knowledge of feeding program administrators, parents, and other child care providers re-

garding bacterial food safety issues. They have also continued to collect data on 60 cases of milk contamination in infants of less than one year old. Work is ongoing to determine the relationship of dairy food safety concerns, perceptions and experiences with dairy product purchases. The fiscal year 1992 grant supports work through August 1994. The fiscal year 1993 proposal has been requested but not received.

Mr. DURBIN. how long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded for milk consumption and milk safety research from funds appropriated as follows: fiscal years 1986 through 1989, $285,000 per year; fiscal year 1990, $281,000; fiscal year 1991, $283,000; fiscal year 1992, $284,000; fiscal year 1993, $184,000. A total of $751,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. This research is being conducted at the Pennsylvania State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The researchers developed a method to detect pathogenic heat injured *Listeria monocytogenes* in pasteurized milk; several pharmaceutical and food companies have expressed interest in the technique and the University is exploring its commercialization. Research demonstrated that some naturally occurring pathogens can survive the heating/freezing cycle designed to control them in soft serve ice cream freezer equipment, thus posing a possible safety hazard. Investigators found that many child care providers and parents are not adequately knowledgeable about bacterial food safety, that they are more concerned with chemical contamination, and that they are not willing to pay more to assure milk safety, believing instead that it should be a guaranteed right.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. It is anticipated that the research on milk safety may be completed in fiscal year 1995.

MINOR CROP PEST CONTROL, HAWAII

Mr. DURBIN. Please provide a description of the work that has been done under the minor crop pest control program to date and the period of the existing contract.

Dr. JORDAN. Pest and disease control on Hawaii's many minor crops depends on an integrated pest management—IPM—program including the judicious use of pesticides. Research will concentrate on pest control strategies for minor crops. Control strategies to be examined will be IPM compatible pesticides, physical treatments such as postharvest heat treatments, biocontrols, and resistant varieties. The fiscal year 1992 grant supports research through July 1993. The 1993 grant has been requested by CSRS.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1990 and the appropriation for fiscal year 1990 was $281,000.

The fiscal years 1991, 1992, and 1993 appropriation is $285,000 per year. A total of $1,136,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. Research is being conducted at the University of Hawaii.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The project has focused on pest and disease problems of papaya and, particularly, finding a replacement postharvest fungicide for the ethylene bisdithiocarbamate fungicides, the "EBDCs." Fruit sprayed with Clorothalonil and anilazine sprays showed phytotoxicity after heat treatment, resulting in blemished, unmarketable fruits. Subsequently, fluazinam was found to have similar effects, but it is possible that modifying the formulation of fluazinam can eliminate the phytotoxicity. Residues of the EBDC fungicide mancozeb and of ethylene thiourea, the EBDC breakdown product, were determined in papaya; the data will contribute to any reassessment by EPA for reinstating papaya on the mancozeb label.

Studies are continuing on residues of malathion insecticide in papaya, guava, and macadamia and fosetyl-aluminum systemic fungicide in papaya.

Technology developed by the project for monitoring the high-temperature forced-air fruit fly disinfestation treatment mandated by APHIS has enabled a successful transition from the previous hot water treatment for the papaya industry. A portable, research-scale papaya heat treatment chamber that was installed on Kauai was damaged by Hurricane Iniki and is now being refitted. The chamber will be used for testing heat treatment effects on the "Sunrise" papaya cultivar and also on other types of fruits that require development of disinfestation protocols.

Research on papaya fruit softening found that pectin hydrolysis and modifications of hemicellulose are related to calcium content. Heat treatments were observed to reduce exoxylanase activity.

Papaya breeding efforts include recurrent selection for resistance to *Phytophthora* and *Colletotrichum* fungi; testing seedlings of the important "Kapoho" cultivar found surviving in abandoned fields against unselected seedlings for resistance to *Phytophthora*; and screening 100 accessions of papaya collected in Central America for resistance to fungal diseases.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that work will be completed?

Dr. JORDAN. The University researchers anticipate the work may be completed in fiscal year 1995. Additional research proposals could be submitted for funding consideration under the pesticide clearance special grant program.

MINOR USE ANIMAL DRUGS

Mr. DURBIN. Please provide a description of the work that has been done under the minor use animal drug program to date and the period of the existing contract.

Dr. JORDAN. In 1982, Interregional Research Project Number 4—IR-4—was revised to include efforts to obtain FDA clearance of animal drugs intended for use in minor species and for minor use

in major species. Funds are divided between the four IR-4 regional animal drug coordinators and the IR-4 Headquarters at Michigan State University for support of the drug clearance program. These funds are being utilized by the regional animal drug coordinators and by allocation to State Agricultural Experiment Stations—SAES—to develop data required for meeting clearance requirements. The research arm of the IR-4 program consists of the regional coordinators, SAES, ARS, USDI Fish and Wildlife Service, schools of veterinary medicine and the drug industry. Each year priorities are established for the various species categories including small ruminants, game birds, fur-bearing animals and bees, and aquaculture species. The fiscal year 1992 grants terminate between February 1993 and February 1994. The fiscal year 1993 grants have been received and are currently being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from appropriated funds in the amount of $240,000 per year for fiscal years 1982-85; $229,000 per year for fiscal years 1986-1989; $226,000 for fiscal year 1990; $450,000 for fiscal year 1991; and $464,000 for fiscal years 1992 and 1993. A total of $3,480,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The grants have been awarded to the four IR-4 regional animal drug coordinators located at Cornell University, the University of Florida, Michigan State University and the University of California-Davis, and to IR-4 Headquarters, Michigan State University. Research is conducted at these universities and through allocation of these funds for specific experiments at the State Agricultural Experiment Stations, the Agricultural Research Service, the USDI Fish and Wildlife Service and in conjunction with several pharmaceutical companies. In 1991 a National Coordinator was established to assist in the coordination of the expanded program.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. To date, 227 drug requests have been submitted to IR-4 for clearance. Working in conjunction with many universities, the USDI Fish and Wildlife Service, ARS and numerous pharmaceutical companies, 19 research projects are now active and will be continued through 1993 to establish data for clearances. Nineteen public master files, which involve 14 new animal drugs in 10 animal species, have been published in the Federal Register related to the use of specific drugs in minor species. One new drug was cleared for use in 1992. Nine additional public master files are currently being reviewed.

The Center for Veterinary Medicine of the Food and Drug Administration is cooperating and supporting this program to the fullest extent. The program is a prime example of Federal interagency cooperation in coordination with academic institutions, pharmaceutical industries and commodity interests to effectively meet an urgent need.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. Selected categories of the Special Research Grants program address important national/regional research initiatives.

The program continues to give emphasis to research on drugs for the expanding aquaculture industry. The minor use animal drugs program involves research on biological systems that by their nature are ever changing and presenting new challenges to agriculture. Especially with the new sensitivities about safety and the environment, there is a high priority for continuation of these ongoing projects.

MULTI-COMMODITY RESEARCH, OREGON

Mr. DURBIN. Please provide a description of the work that has been done under the multi-commodity research program to date and the period of the existing contract.

Dr. JORDAN. The purpose of the program is to provide multi-commodity agricultural marketing activities to assist regional producers and agribusinessmen in penetrating new and expanding markets in the Pacific Rim. CSRS has requested Oregon State University to submit a grant proposal for fiscal year 1993 that has not yet been received.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant begins in fiscal year 1993. The appropriation for fiscal year 1993 is $300,000.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. The research program will be carried out at Oregon State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The University has been requested to provide a proposal with a plan-of-work for the research program.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. A termination date has not been established by the researchers.

MULTI-CROPPING STRATEGIES FOR AQUACULTURE, HAWAII

Mr. DURBIN. Please provide a description of the work that has been done under the multi-cropping strategies for aquaculture research in Hawaii to date and the period of the existing contract.

Dr. JORDAN. The objective of this research is to develop design criteria for the coproduction of shrimp and oysters in aquacultural systems. Oyster production strategies and production systems have been evaluated and the research has been commercialized. The current production systems are being refined with alternative species of oysters being evaluated. The fiscal year 1992 grant supports research through July of 1994. The fiscal year 1993 grant proposal has been requested but has not yet been received.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. This research was initiated in fiscal year 1987 and $152,000 per year was appropriated in fiscal years 1987 through 1989. The fiscal year 1990, 1991, 1992, and 1993 appropriations are $150,000 per year. A total of $1,056,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of Hawaii.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Research has led to the development of production systems that have been field tested under commercial conditions. Oyster production systems have been developed that utilize waste from shrimp production systems and produce an additional high value crop.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The researchers have indicated that all of the initial research objectives will have been completed under the support provided in fiscal year 1992. The university has not submitted the fiscal year 1993 proposal so a completion date has not been projected.

NATIONAL BIOLOGICAL IMPACT ASSESSMENT PROGRAM

Mr. DURBIN. Please provide a description of the work that has been done under the National Biological Impact Assessment Program to date and the period of the existing contract.

Dr. JORDAN. The National Biological Impact Assessment Program's—NBIAP—mission is to facilitate and assess the safe application of new technologies for the genetic modification of plants, animals, and microorganisms to benefit agriculture and the environment. The fiscal year 1992 grant supported research through December 1992. The fiscal year 1993, grant has been awarded and supports research through December 1993.

Mr. DURBIN. How long has this work been under way and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $125,000; fiscal year 1990, $123,000; and fiscal years 1991 and 1992 and 1993, $300,000 per year. A total of $1,148,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research coordination is being provided by The Virginia Polytechnic Institute and State University. Former and current partners in the program include The Pennsylvania State University, Louisiana State University, North Carolina Biotechnology Center, University of Arizona, University of Missouri, Purdue University, and the National Agricultural Library.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Within the past year the program has expanded access to the electronic bulletin board system which receives over 120 calls per day from individuals seeking information on the safe applications of biotechnology to agriculture and the environment. The program also expanded the monthly electronic news report for greater coverage and improved databases for more rapid access and reduced information transmission rate costs. NBIAP issued a permit application software which facilitates the design for safe experiments and the drafting of applications for Federal permit to conduct field tests with genetically-modified organisms. This software was expanded to prompt scientists on the preparation of a termination report—required at the end of each experiment—re-

garding biosafety observations. Through subcontracts, NBIAP supported research in risk assessment, at two locations, and supported the development of a biological monitoring database that is still under development, and should be released on a CD ROM in calendar year 1993.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. There remains a continuing need to address the safety of field testing genetically modified organisms with respect to agriculture and the environment. This program has been very successful in providing essential information on the conduct of safe field experiments, and thus the program remains a high priority and will need to be extended beyond the initially planned five years.

NEMATODE RESISTANCE GENETIC ENGINEERING, NEW MEXICO

Mr. DURBIN. Please provide a description of the work that has been done under the nematode resistance genetic engineering program to date and the period of the existing contract.

Dr. JORDAN. The proposed research will explore alternatives to pesticide to decrease or eliminate current mandatory reliance on soil-applied pesticides which are now or are likely to become significant contaminants of ground water. The research involves creating resistance to nematodes within the plants themselves by utilizing qualities from various predacious fungi and other mammalian sources, and to transfer the genetic information required for predation from the fungus to a plant. The fiscal year 1992 grant supports research through September 1993. The fiscal year 1993 proposal is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1992?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991 and the appropriation for fiscal years 1991, 1992, and 1993 was $150,000 per year. A total of $450,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the New Mexico State University, and at collaborating universities in the region.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The project has successfully inserted the collagenase gene into plants and obtained expression of the trait. Bioassays have demonstrated activity of the resistance against plant parasitic nematodes, thus showing the feasibility of this innovative approach of genetic engineering.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The Consortium has indicated that the objectives will be completed by fiscal year 1996.

NEW USES FOR AGRICULTURAL PRODUCTS, OHIO

Mr. DURBIN. Please provide a description of the work that has been done under the new uses for agricultural products program to date and the period of the existing contracts.

Dr. JORDAN. This project is funding research to characterize existing markets, identify potential utilization opportunities, develop and evaluate high-potential opportunities, and create and assess strategies to enhance farm income by exploiting new markets. The fiscal year 1992 grant supports research through August 1993. The University has submitted a grant proposal for fiscal year 1993 and it is being reviewed.

Mr. DURBIN. How long has this work been underway, and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal years 1988 and 1989, $133,000 per year; fiscal year 1990, $131,000; and fiscal years 1991, 1992, and 1993, $140,000 per year. A total of $817,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. The research is being carried out at Ohio State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The first two of the four objectives are complete. These objectives were characterization of the existing major markets for agricultural products and identifying potential opportunities to increase utilization. This resulted in a set of research papers and a conference. Progress on the projects for the remaining two objectives are well advanced. These objectives are developing and evaluating high-potential opportunities to expand utilization and assess strategies or innovations for farmers to enhance income by exploiting new market opportunities for new projects. No new projects have been proposed.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The original program of research is essentially completed.

NONFOOD AGRICULTURAL PRODUCTS, NEBRASKA

Mr. DURBIN. Please provide a description of the work done under the nonfood agricultural products program to date and the period of the existing contract.

Dr. JORDAN. This work focuses on the identification of specific market niches that can be filled by products produced from agricultural materials, developing the needed technology to produce the product, and working with the private sector to transfer the technology into commercial practice. Major areas of application include starch-based polymers, products from milkweed, use of tallow and other animal by-products, and improvements in ethanol production. The fiscal year 1992 grant supports research through October, 1993. The proposal for the fiscal year 1993 grant has been received and is under review for funding.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work began in fiscal year 1990 with an appropriation of $109,000. The fiscal year 1991, 1992, and 1993 appropriations are $110,000 per year. A total of $439,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The work is being done by the Industrial Agricultural Products Center at the University of Nebraska which was established by the Nebraska Board of Regents on May 6, 1988, to broaden markets for agricultural commodities produced in Nebraska.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. A process for the continuous co-extrusion of starch, polystyrene, and other food grade chemicals has been developed. The process has a patent application pending and commercialization efforts are in progress. In another process, polymer films have been made using vegetable proteins from corn, wheat, and soybeans. The biofuels efforts have been in emissions testing for soy diesel and in the production of biodiesel fuels from animal tallows.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The Center's researchers plan to seek two more years of funding at which time they hope the Center will be able to support itself fully from other resources generated by their programs.

OIL FROM JOJOBA, NEW MEXICO

Mr. DURBIN. Please provide a description of the work that has been done under the oil from jojoba program to date and the period of the existing contract.

Dr. JORDAN. The Plant Genetic Engineering Laboratory—PGEL—of New Mexico State University is entering the fifth year of research to transfer the liquid wax producing capability of jojoba into oilseed plants such as rapeseed and soybean. It is anticipated that success could result in the means to make jojoba liquid wax products commercially viable. This is a major PGEL program to exploit unique oil resources from desert plants and is a long-term collaborative effort among senior faculty with interests in plant oils and lipids.

Two enzymatic activities uniquely responsible for wax biosynthesis have been identified and the project is attempting to construct a metabolic pathway using recombinant DNA technology. To date, the genetic sequence for the reductase enzyme has been virtually completed. Ongoing research to identify the full length of the gene itself is complicated by a gene component—interons—that are of a size unusual in plants. Using a genetic alteration technology—tissue culture—established by PGEL, transgenic rapeseed plants will be created to test for indicators of synthesis and storage of jojoba-like liquid wax. The tissue culture work has been affected by a laboratory fire during December, 1992.

A second challenge facing PGEL is the identification and extraction of the second enzyme transacylase. In a progressively narrowing search, photo affinity is a new technology being used to find and tag this very difficult to isolate enzyme. Another technology is then needed for chemical synthesis of the enzyme. As with reductase, procedures would then be followed to create and test transgenic rapeseed plants. The fiscal year 1992 grant supports research through February, 1994. The 1993 grant proposal has been received and is being processed for research through September 1995.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. This work began in fiscal year 1989 with a $100,000 grant under the Supplemental and Alternative Crops program. Grants have been awarded under the Special Research Grants program as follows: fiscal year 1990, $148,000; fiscal years 1991, 1992 and 1993, $200,000 per year. A total of $848,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research is being conducted by the Plant Genetics Engineering Laboratory at New Mexico State University, Las Cruces, New Mexico.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Major accomplishments to date have been identification of two enzymes responsible for wax biosynthesis, establishing the technology for genetic alteration of rapeseed, genetic sequencing of the reductase enzyme, and adoption of photo affinity technology for research application on the transacylase enzyme.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. While originally planned as a five year program for 1989–1993, PGEL now anticipates that two to three years of additional work will be needed to bring the project to completion.

PEACH TREE SHORT LIFE, SOUTH CAROLINA

Mr. DURBIN. Please provide a description of the work that has been done under the peach tree short life program to date and the period of the existing contract.

Dr. JORDAN. Progress continued in 1992 to identify genetic material in peaches that might be useful as rootstocks in soils where the ring nematode, *Criconemella xenoplax*, is present and contributing to peach tree short life. Field trials of selected rootstocks are under way. No clear source of resistance was found among hundreds of breeding lines tested, but several lines that have supported lower populations of the nematode are being tested for tolerance. A bacterium associated with peach roots in an orchard where low nematode populations have been consistent for many years was studied as a biological control agent for ring nematodes. Additional studies of the physiological effects on peach trees resulting from ring nematode parasitism continued in 1992. The fiscal year 1992 grant supports research through March 1994. The fiscal year 1993 grant is being reviewed and will support research through March 1995.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1981, $100,000; fiscal years 1982–1985, $192,000 per year; fiscal years 1986–1988, $183,000 per year; fiscal year 1989, $192,000; fiscal year 1990, $190,000; and fiscal years 1991–1993, $192,000 per year. A total of $2,375,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research is being conducted at the South Carolina Agricultural Experiment Station.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Several peach breeding lines, as well as two plum lines, with partial resistance to *C. xenoplax* were found in field tests for nematode-tolerant rootstock germplasm. The numbered rootstock peach selection 520–9 performed exceptionally well in field plantings in 1992. Trees on 520–9 grow well, and exhibit good cropping and acceptable horticultural characteristics. Development of 520–9 as a commercial rootstock for peach production has progressed with bulk seeds made available to nurseries to test suitability as rootstock material. Field testing and characterization of fluorescent pseudomonads as biocontrol agents for *C. xenoplax* resulted in the isolation of a *Pseudomonas* strain which holds nematode populations to a fraction of those present in nontreated soils. A marker was inserted into this strain in order to study the behavior of the bacterium in the soil and colonization of the roots of peach. Studies on the mechanism of nematode inhibition by this strain reveal that it prevents hatching of nematode eggs if eggs are exposed within six days after deposition by the nematode. The evaluation of nimblewell as a ground cover will continue in fiscal year 1993.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1996.

PERISHABLE COMMODITIES, GEORGIA

Mr. DURBIN. Please provide a description of the work that has been done under the perishable commodities program to date and the period of the existing contract.

Dr. JORDAN. The overall objective of this research will be to investigate federal and private sector grade standards governing the cosmetic appearance of perishable commodities and determine how they affect pesticide use. The term "cosmetic appearance" refers to the external appearance of a commodity without any significant influence on yield, taste, nutritional value or safety. The research will determine pesticide application amounts on perishable commodities, the extent to which federal grade standards affect pesticide use, the effect of reducing emphasis on cosmetic appearance in grade standards upon use of pesticides and adoption of agricultural practices that will result in reduced pesticide use and the extent to which grade standards reflect consumer preferences. The fiscal year 1993 proposal has been received and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated for fiscal year 1993?

Dr. JORDAN. The work supported by this grant begins in fiscal year 1993 and the appropriation for fiscal year 1993 is $250,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research will be conducted at the University of Georgia.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. CSRS has requested the university to submit a grant proposal that has been received. The grant has not yet been awarded. The CSRS staff reviewed the proposal and asked that those sub-

mitting the proposal consider a number of suggestions offered to improve it. CSRS has not yet received a response.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1995.

PEST CONTROL ALTERNATIVES

Mr. DURBIN. Please provide a description of the work that has been done under the pest control alternatives program to date and the period of the existing contract.

Dr. JORDAN. Pest controls are being developed to substitute for chemical pesticides in vegetable crops by scientists funded by this project. They have discovered new strains of organisms that may be used to control bacterial spot disease of tomatoes and peppers, diamondback moth, and imported cabbage worm. They are developing ways of killing or inhibiting pests in soils by synthetic mulches. A pilot IPM program has been implemented for collared production to transfer this research technology to producers. The fiscal year 1992 grant supports research through April 1994. The 1993 grant proposal has been received and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992 and the appropriation for fiscal years 1992 and 1993 was $125,000 per year. A total of $250,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research is being conducted at the South Carolina Agricultural Experiment Station.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Biological control agents are being selected for bacterial spot of tomato and pepper, wirestem of crucifers, and seedling diseases of *Brassica* cultivars. Pathogens and parasites of several pest caterpillars are being sought in Indonesia, Korea, and China. Effectiveness and optimal use patterns are being developed for these biological control agents. Work will continue toward development of ways to use synthetic mulches to disinfect field soils of pests by using the heat rays of the sun—soil polarization.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in four years.

PESTICIDE CLEARANCE

Mr. DURBIN. Please provide a description of the work that has been done under the pesticide clearance program to data and the period of the existing contract.

Dr. JORDAN. The pesticide clearance program—IR–4—includes the State Agricultural Experiment Stations and United States Department of Agriculture-Agricultural Research Service—ARS. IR–4 provides the national leadership, coordination and focal point for obtaining tolerance and safety data for pesticides and biological control agents for specialty crops such as horticultural crops. The

agricultural chemical industries have not economically justified the time and expense to conduct the necessary research for pesticides with small market potential. With the Federal registration resulting from this research, a large number of small acreage crops such as vegetables, fruits, nuts, spices and other specialized crops have been provided with needed crop protection against pests. Under the auspices of this research program, a group of scientists representing the State and Territorial Agricultural Experiment Stations continually define and update pest control technologies for minor crops needed by farmers, ranchers, and others. Protocols are written after careful review with representatives of grower groups, the chemical industry and researchers. The researchers than carry out field trials on priority needs to determine their effectiveness, safety and usefulness and then analyze the field grown commodities, where appropriate, to identify and quantify any residue that may persist. All of this is done according to Good Laboratory Practice guidelines. The research program then assimilates the data from all the participating experiment stations, grower groups and chemical industry, and petitions are written for tolerances and Federal registration or reregistration. The 1992 grants terminate between February 1993 and September 1993. Grants for 1993 have been received and are being processed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: Program redirection in fiscal year 1975, $250,000; fiscal year 1976, $500,000; fiscal years 1977–1980, $1,000,000 per year; fiscal year 1981, $1,250,000; fiscal years 1982–1985, $1,400,000 per year; fiscal years 1986–1989, $1,369,000 per year; fiscal year 1990, $1,975,000; fiscal year 1991, $3,000,000; and fiscal years 1992 and 1993, $3,500,000 per year. A total of $29,211,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Field work is performed at the State and Territorial Experiment Stations. Laboratory analysis is conducted primarily at the California, New York, Florida and Michigan Agricultural Experiment stations with assistance by the Oregon, Hawaii, North Dakota, Arkansas, North Carolina, Washington, Virginia, Massachusetts, Pennsylvania and New Jersey Agricultural Experiment Stations. Protocol development, data assimilation, writing petitions, and registration processing are coordinated through the New Jersey Agricultural Experiment Station. ARS is conducting minor use pesticide studies at locations in California, Georgia, Illinois, Maryland, Mississippi, Ohio, Oregon, South Carolina, Texas, and Washington. ARS laboratories located in Georgia, Maryland and Washington are cooperating with analyses.

Mr. DURBIN What has been accomplished to date?

Dr. JORDAN. Since its beginning, the IR–4 Project has been responsible for data to support 4,156 clearances, representing 1,041 tolerances and exemptions on food. In addition, 14 biological pest control agents have received clearance. For ornamental crops, a total of 3,650 labels for uses of pesticides have been issued.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. Selected categories of the Special Research Grants program address important national and regional research initiatives. The pesticide clearance program involves research on biological systems that by their nature are ever changing and presenting new challenges to agriculture. The IR-4 workload is anticipated to be long term because of the new sensitivities about food safety and the environment, plus the 1988 amendments to FIFRA regarding reregistration. IR-4 administration has developed a strategy in response to the FIFRA '88 amendments to register 2,600 new minor uses and reregister 1,000 needed minor uses. Additionally, the biocontrol pest program which promotes new and safer pest control technology for minor crops will be expanded.

PESTICIDE IMPACT ASSESSMENT

Mr. DURBIN. Please provide a description of the work that has been done under the pesticide impact assessment program to date and the period of the existing contract.

Dr. JORDAN. The National Agricultural Pesticide Impact Assessment Program, NAPIAP, is a coordinating mechanism for USDA and State research activities and information sources which promote informed regulatory decisions on registered, agricultural pesticides. NAPIAP is a multiagency effort which, under its new structure, draws on the expertise primarily from United States Department of Agriculture agencies and their cooperators in State Agricultural Experiment Stations—SAES—Cooperative Extension Services, and State Departments of Agriculture. CSRS-NAPIAP funds together with those of Extension Service have provided support for the participation of 53 States and Territories in this program. The NAPIAP focal point in each state serves as the primary link between Federal and state agencies, as well as clientele groups on a variety of pesticide issues. SAES scientists have also been funded through CSRS-NAPIAP for research to fill information needs and for assessment team activity.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal years 1977–1981, $1,810,000 per year; fiscal years 1982–1985, $2,069,000 per year; fiscal years 1986–1988, $1,968,000 per year; fiscal year 1989, $2,218,000; fiscal year 1990, $2,437,000; and fiscal years 1991, 1992 and 1993, $2,968,000 per year. A total of $36,789,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. This work is underway at SAES in 53 States and Territories. Competitively awarded research funds to fill informational needs are coordinated through a lead State in each of the four regions of the United States which are the West, California; North Central, Ohio; Northeast, Pennsylvania; and the South, Georgia.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Research efforts to date have contributed important information on environmental effects, human exposure risks, economic impacts and yield/quality data. Information has been generated which is useful in minimizing potential risks; this includes ap-

plication technology, pesticide detection methodology, and determination of factors governing environmental fate. Additional regulatory activity associated with re-registration and impacts on non-target organisms will require increased research on the ramification of pesticide use. Assessment activity is anticipated to increase. An economic impact model is in the final steps of pilot testing and will be made available for expanded use.

Other NAPIAP sponsored work includes a study to determine the movement and fate of methyl bromide in soil; an assessment, designed to serve as a model, of the impact of fungicides on tomato yield/quality; and sponsorship of a project to increase the utility of a computer based toxicology database. The CSRS–NAPIAP representative is also actively involved in USDA's efforts to identify alternatives to methyl bromide.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. Selected categories of the Special Research Grants program address important national/regional research initiatives. The pesticide impact assessment program involves research on biological systems that by their nature are ever changing and presenting new challenges to agriculture. There is a high priority for continuation of these ongoing projects particularly in view of increased public concerns about food safety and the environment.

In addition, we are concerned about an increased workload resulting from FIFRA '88. An allied program, IR–4, is currently addressing about 25 percent of its resources to the reregistration effort as a result of FIFRA '88. The NAPIAP and IR–4 programs have discussed and implemented several specific high priority cooperative projects. Each program will collect critical data to be used in support of reregistration. In addition to cooperative efforts with IR–4, there are specific projects that NAPIAP is addressing in support of reregistration. Activites related to reregistration under FIFRA '88 are projected to be complete by the end of calendar year 1997.

PESTICIDE RESEARCH, WASHINGTON

Mr. DURBIN. Please provide a description of the work that has been done under the pesticide research program to date and the period of the existing contract.

Dr. JORDAN. This special grant is for Washington, Idaho and Oregon to establish a cooperative pesticide analytical and information program for food quality/pesticide research with Washington State University as the lead organization. The purpose of the research is to ensure the continued availability of pesticides required by producers of crops and animal products in the tri-state region. Objectives include: determine the range of pesticide residue studies needed by producers and processors, with emphasis on regional speciality crops; identify crops and animal products with anticipated critical residue investigations needed in the next decade; project the types of studies needed to control environmental contamination by pesticides; identify development needs, such as general laboratory availability, and operational costs; and identify appropriate support staff requirements. Washington has established a Food and

Environment Quality Laboratory to investigate the fate of pesticides on crops and in the environment and to support minor crop registrations through the IR–4 program. The fiscal year 1992 grant supports research through February 1994. The 1993 grant has been requested.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from appropriated funds as follows: fiscal year 1990, $49,000; fiscal year 1991, $484,000; and fiscal year 1992 and 1993, $667,000 per year. A total of $1,868,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Washington State University in cooperation with the University of Idaho and Oregon State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Funding for the laboratory from the Washington state legislature has been secured. Subcontracts with Oregon and Idaho have been established. Idaho is developing a Tri-state data management system to handle information generated by the laboratory. Oregon is developing analytical methods for registration of pesticides and for determining the behavior of pesticides in ground water and air. An environmental quality specialist has been hired. Space has been identified and renovation of laboratory space is in the final stages of completion. Equipment is being purchased to support the program. The issue of food safety and environmental quality has emerged as a high priority issue in the long-term planning of the College of Agriculture and Home Economics at Washington State University. The Food and Environmental Quality Laboratory serves as a focal point, for a substantial increase in activity by other faculty which contribute directly to the goals of the laboratory.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work through fiscal year 1996 should result in significant achievements towards the objectives of this project.

PHYTOPHTHORA ROOT ROT, NEW MEXICO

Mr. DURBIN. Please provide a description of the work that has been done under the Phytophthora root rot program to date and the period of the existing contract.

Dr. JORDAN. The objectives of this research are to develop improved control of Phytophthora root rot in various types of Chile cultivars. Disease resistance has been identified and breeding has been initiated. Cultural practices such as water management are also being investigated. Considerable progress has been made in initiating a Chile breeding program for disease resistance. The fiscal year 1992 grant supports research through March 1993. The fiscal year 1993 grant is being reviewed and will support research through March 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work support by this grant began in fiscal year 1991 and the appropriation for fiscal year 1991 was $125,000. The fiscal years 1992 and 1993 appropriation was $150,000 per year. A total of $425,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at New Mexico State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. With financial support obtained from the New Mexico Chile Commission and from CSRS, scientists have begun introducing disease resistance into several types of peppers. In the summer of 1992, advanced lines of root rot resistant material were grown and evaluated for horticultural traits. Based upon preliminary evaluations of the results, a cultivar suitable for red chile production may be ready for release in the near future. Other sources of genetic resistance were found in accessions for Asia and the US, five of which were "field-resistant" plants which survived a devasing attack of root rot in New Mexico. An extensive breeding program is underway to introduce the resistance into commercially acceptable cultivars. A new statistical technique was devised to assess superior cultivars and to assess environmental factors which contribute to the development of root rot disease.

Mr. DURBIN. When do the principal researchers carrying out his work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1995.

POTATO RESEARCH

Mr. DURBIN. Please provide a description of the work that has been done under the potato research program to date and the period of the existing contract.

Dr. JORDAN. Scientists at several of the State Agricultural Experiment Stations in the Northeast, Northwest, and North Central States, are breeding russet type, high yielding, disease and insect resistant potato cultivars, adapted to the growing conditions in their particular areas, both for the fresh market and for processing. Research is being conducted in such areas as protoplast regeneration, somoclonal variation, storage, propagation, germplasm preservation, and cultural practices. The fiscal year 1992 grants terminate between March 1993 and June 1994. The 1993 grants have been requested and are being processed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1983, $200,000; fiscal year 1984, $400,000; fiscal year 1985, $600,000, fiscal years 1986–1987, $761,000 per year; fiscal year 1988, $997,000; fiscal year 1989, $1,177,000; fiscal year 1990, $1,310,000; fiscal year 1991, $1,371,000; and fiscal years 1992 and 1993, $1,435,000 per year. A total of $10,447,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research work is being carried out at the Cornell, Idaho, Maine, Maryland, Michigan, North Dakota, Oregon,

Pennsylvania, and Washington State Agricultural Experiment Stations.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. This research has resulted in a number of new high yielding, good quality, disease and insect resistant, russet type cultivars, which are now being used in the processing industry and in the fresh market.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate the work will be completed?

Dr. JORDAN. The university researchers anticipate the their work may be completed in fiscal year 1995.

POTATO UTILIZATION, NORTH DAKOTA

Mr. DURBIN. Please provide a description of the work that has been done under the program to date and the period of the existing contract.

Dr. JORDAN. The university anticipates it will request support for five projects. The objectives of the research are to screen potato germplasm for unique starches with commercial potential, to develop a computer based decision-support system for processing of french fries, to determine the economic potential of all food and nonfood uses of potatoes and potato byproducts, to study the effects of management practices and environmental stresses on french fry quality of processing varieties with the idea to genetically engineer stress-resistant genotypes, and to develop a cost effective and environmentally safe procedure for synthesizing starch polymers which would be completely biodegradable in the long run. The fiscal year 1993 proposal has been requested but it has not been received.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant begins in fiscal year 1993 and the appropriation for fiscal year 1993 is $250,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research will be conducted at North Dakota State University and in cooperation with the USDA Potato Research Laboratory in East Grand Forks, Minnesota.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The overall objective of the project is to improve the quality of potatoes for food use and to identify and develop market opportunities for new food and nonfood uses of potatoes and byproducts that will lead to increased value-added processing in North Dakota.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The University researchers anticipate that work may be completed in fiscal year 1998.

POULTRY RESEARCH, GEORGIA

Mr. DURBIN. Please provide a description of the work that has been done under the poultry research program to date and the period of the existing contract.

Dr. JORDAN. The research focuses on ways to improve the efficiency of production, wholesomeness and quality of poultry meat.

The fiscal year 1992 grant supports research through April 1993. The fiscal year 1993 proposals have been received and are under review.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992 and the appropriation for fiscal year 1992 was $172,000. The fiscal year 1993 appropriation is $516,000. A total of $688,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of Georgia.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The fiscal year 1992 research is still underway. Information that will define optimum temperature for proper storage and refined microbiological processes that can detect storage abuses in processed poultry meat is being developed.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The efforts are proposed to be completed in fiscal year 1996.

PRESERVATION AND PROCESSING RESEARCH, OKLAHOMA

Mr. DURBIN. Please provide a description of the work that has been done under the preservation and processing research program to date and the period of the existing contract.

Dr. JORDAN. Fruit and vegetable cultivars have been evaluated for harvest quality and storage and shipping potential, biological processes limiting shelf life and potential for mechanical harvest of fresh horticultural commodities have been investigated, optimum storage and shipping conditions for commodities have been identified, and a device was developed to nondestructively measure maturity for selected fruits and vegetables. The fiscal year 1992 grant supports work through June 1994. The fiscal year 1993 proposal has been received, is being reviewed and will support work through June 1995.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1985, $100,000; fiscal year 1986, $142,000; fiscal year 1987, $242,000; fiscal years 1988 and 1989, $267,000 per year; fiscal year 1990, $264,000; fiscal year 1991, $265,000; fiscal year 1992, $282,000; and fiscal year 1993, $267,000. A total of $2,096,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. This work is being conducted at the Oklahoma State Agricultural Experiment Station.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. A prototype instrument for on-line non-destructive determination of harvest maturity and quality during handling and storage of selected fruits and vegetables was fabricated by researchers. Shelf life of fresh peaches was extended dramatically by storing at very high humidity with low air velocity.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1997.

PROCERUM ROOT DISEASE, VIRGINIA

Mr. DURBIN. Please provide a description of the work that has been done under the procerum root disease program to date and the period of the existing contract.

Dr. JORDAN. Research will study the epidemiology of the disease that should lead to effective methods for its control. Since the disease is transmitted by insects, the university scientists will study vector behavior to determine when they are likely to transmit the fungal pathogen. In addition, various chemical insecticides will be tested to determine if they are effective in controlling this disease. The fiscal year 1992 grant supports research through February 1993. The fiscal year 1993 grant is being reviewed and will support research through February 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992, and the appropriation for fiscal years 1992 and 1993 was $25,000 per year. A total of $50,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the Virginia Polytechnic Institute and State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Volatiles released by cutting of trees in autumn are attractive to insects. Trapping of insects has shown that two insect species predominate. Of the most abundant species, a high proportion of the insects, up to 90 percent, carry the fungal spores of procerum root rot on their legs. Following application of insecticides to pine stumps, the insecticides appear to act as a repellent or a feeding deterrent to the insects. The long-term residual activity of the chemicals will be evaluated in the following season.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1994.

PRODUCT DEVELOPMENT AND MARKETING CENTER, MAINE

Mr. DURBIN. Please provide a description of the work that has been done under the product development and marketing center program to date and the period of the existing contract.

Dr. JORDAN. The purpose of this grant is to conduct a program of research to develop and promote new value-added agriculture, aquaculture, and forest products. Investigators have implemented research to inventory the region's sustainable timber supply and processing capability, assess and develop fishery products and market efficiency, and develop value-added agriculture products and assess export markets. Collaborative arrangements with other Northern New England universities have been implemented. The fiscal year 1992 grant supports research through September 1993.

The university has submitted a grant proposal for fiscal year 1993 and the proposal is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992. The appropriation for fiscal years 1992 and 1993 is $221,000 per year. A total of $442,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. The research program is carried out by the University of Maine.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Projects have been initiated to determine the sustainable supply of timber in the region, assess the export capability of the region's forest products industry, and evaluate the efficiency of the marketing infrastructure. Studies are about to be initiated to assess European export markets for value-added forest products that are or can be produced in the region. A project has been completed to assess the market for spiny dogfish and other projects are underway on freezing lobsters, develop new potato products from peels, assess markets for Maine seed potatoes, expand specialty food markets, and assess preferences and export markets for apples grown in the region.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The agreement under which this research is being conducted terminates in 1997.

RED RIVER CORRIDOR, MINNESOTA AND NORTH DAKOTA

Mr. DURBIN. Please provide a description of the work that has been done under the Red River Corridor program to date and the period of the existing contract.

Dr. JORDAN. The purpose is to conduct a program of research to assess economic development opportunities for the Red River Valley region and the infrastructure to support those opportunities. The fiscal year 1992 grant supports research through August 1993. The University has submitted a grant proposal for fiscal year 1993 that is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992. The appropriation for fiscal years 1992 and 1993 is $200,000 per year. A total of $400,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. The research program is carried out by the University of Minnesota, Crookston, in collaboration with North Dakota State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Projects were initiated to assess the Corridor's infrastructure and competitiveness, its research and development support capability, and export potential in North America and France.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The researchers indicate that the work may be completed in fiscal year 1997.

REGIONAL BARLEY GENE MAPPING PROJECT

Mr. DURBIN. Please provide a description of the work that has been done under the regional barley gene mapping program to date and the period of the existing contract.

Dr. JORDAN. The objectives of this project are to: construct a public, medium resolution barley genome map; use the map to identify and locate loci, especially quantitative trait loci controlling economically important traits such as yield, maturity, adaptation, resistance to biotic and abiotic stresses, malting quality, and feed value; provide the basis and framework for efficient molecular marker assisted selection strategies and barley varietal development by design; identify chromosome regions for further, higher resolution mapping with the objective of characterizing and utilizing genes of interest; and establish a cooperative mapping project ranging from molecular genetics to breeding that will be a functional and organizational model for cereals and other crop plants. The fiscal year 1992 grant supports research through June 1993. The fiscal year 1993 grant proposal has been received and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1992?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1990, $153,000; fiscal year 1991, $262,000; and fiscal years 1992 and 1993, $412,000 per year. A total of $1,239,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted in the following states: Oregon, Colorado, Washington, Michigan, Montana, Idaho, North Dakota, Minnesota, Alaska, New York, and Virginia.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The project has successfully mapped 295 molecular markers, with another 100 markers expected to be placed on the map by June 30, 1993. The map is described as very dense and contains key location structures for enhanced utility. The project has also identified quantitative traits loci of economic importance. These include genetic determinations for yield, maturity, rust resistance, height, seed dorminancy, and the components of malting quality. Manuscripts are being prepared to report to the scientific community on the map and the associated quantitative trait loci.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. It is anticipated that researchers will complete the four year program plan at the end of fiscal year 1994.

REGIONALIZED IMPLICATIONS OF FARM PROGRAMS

Mr. DURBIN. Please provide a description of the work that has been done under the program on regionalized implications of farm programs to date and the period of the existing contract.

Dr. JORDAN. The objective of this research is to estimate the regional and local impacts of farm and trade policies and programs

and their alternatives on the economic viability of typical crop and livestock producers located in different parts of the United States. The fiscal year 1992 grant to Texas A&M University supports research through February 1993. The fiscal year 1992 grant to the University of Missouri supports research through March 1993. The universities have submitted their fiscal year 1993 proposals which are being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1990 and the appropriation for fiscal year 1990 was $346,000. The fiscal years 1991, 1992, and 1993 appropriations are $348,000 per year. A total of $1,390,000 has been appropriated through fiscal year 1993.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted by the Texas A&M University and University of Missouri.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The primary objective is to implement a farm level policy analysis system encompassing major United States farm production regions. This system interfaces with existing agricultural sector models used for farm, macroeconomic, and trade policy analysis. The universities are currently expanding the number and types of representative farms beyond the current 29 to broaden commodity coverage to additional regions in the U.S. Analyses are being conducted to assess the regional and farm impacts of and proposed amendments to the Food, Agriculture, Conservation, and Trade Act of 1990 including making estimates of different set-aside, paid diversion, crop flexibility, and long-term conservation options; identify regional cost and return characteristics; assess tax policies; and analyze effects of North American Free Trade Agreement and General Agreement on Trade and Tariffs provisions.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. This project will be completed when the 1995 Farm Bill legislation and trade legislation are enacted.

RURAL DEVELOPMENT CENTERS

Mr. DURBIN. Please provide a description of the work that has been done under the rural development centers program to date and the period of the existing contract.

Dr. JORDAN. The centers address a broad spectrum of problems facing rural areas. The centers' most important task is to provide a catalytic base to stimulate and focus the research leadership within the land-grant institutions. The fiscal year 1992 grants terminate between August 1994 and August 1995. Proposals for the fiscal 1993 awards have been requested and received from three Centers. These are currently being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1971, $75,000; fiscal year 1972, $225,000; fiscal year 1973, $317,000; fiscal year 1974 through fiscal year 1981,

$300,000 per year; fiscal year 1982 through fiscal year 1985, $311,000 per year; fiscal year 1986 and fiscal year 1987, $363,000 per year; fiscal year 1988, $475,000; fiscal year 1989, $500,000; fiscal year 1990, $494,000; and fiscal years 1991, 1992, and 1993, $500,000 per year. A total of $7,956,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The regional rural development centers are located as follows: Northeast Regional Center for Rural Development, Pennsylvania State University; North Central Regional Center for Rural Development, Iowa State University; Southern Rural Development Center, Mississippi State University; Western Rural Development Center, Oregon State University. Most of the research sponsored by the four regional centers is actually performed by resident faculty at land-grant universities in the respective region through subcontracts from the center's grant. In addition, a special project at North Dakota State University is included in the appropriation.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Results of the projects are reported annually in a comprehensive report. Examples from the 1992 report include the following. The economic feasibility of recycling polystyrene waste from small rural communities was the subject of a seed grant from the North Central Center. This funding provided initial data and a proposal for a complete study that was eventually funded by State and private industry. The pilot program from this research now operates without subsidy beyond normal outlays for consumer education. A report published by the Southern Center indicates that foreign direct investment is a viable mechanism for rural development and that foreign owned firms behave very much like domestic firms in their impacts on rural communities. Therefore, it is not necessary to have new programs to attract foreign, versus domestic, investment. A Western Center study of Western small towns found that while food and household supplies were readily available, clothes were more difficult to find. Prices for the available inventory of food and clothing were only slightly higher than in large cities, but this was offset by lower housing and health care costs in the small towns. These findings contradict most commonly held assumptions about both the availability of consumer goods and the cost of living in small towns and rural places. A Southern Center study concluded that events in the school affecting educational outcomes are strongly influenced by family and community factors over which the schools have no control. The effectiveness on reform efforts aimed at the schools is weakened unless these external factors also are addressed. In particular, measures of output, such as test scores, may be greatly affected by the external factors and thus not accurately reflect the impact of the in-school program. Education is critical to rural development efforts, and this finding should help focus attention on its improvement.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. A specific termination date has not been identified.

RURAL ENVIRONMENTAL RESEARCH—ILLINOIS

Mr. DURBIN. Please provide a description of the work that has been done under the rural environmental program to date and the period of the existing contract.

Dr. JORDAN. Field research was jointly initiated in Western Illinois by the University of Illinois and Western Illinois University to evaluate the effect of alternative farming systems on economic sustainability and environmental quality. Scientists from the National Soil Tilth Laboratory of the United States Department of Agriculture, Agricultural Research Service, located at Ames, Iowa, are also collaborating in this research. Computer information programs for estimating costs and returns and analyzing farmers decisions on sustainable agriculture systems were obtained, tested in the field, and put into use by project coordinators. Also, detailed soil sampling and analyses were completed on the conventional and sustainable agriculture farms being studied to compare soil productivity characteristics under the two farming systems. The fiscal year 1992 grant supports research through June 1993. The proposal for the fiscal year 1993 grant has been received and is currently being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991 and the appropriation for fiscal year 1991 was $75,000. The fiscal years 1992 and 1993 appropriation is $125,000 per year. A total of $325,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at field sites and laboratories at the University of Illinois, Urbana, at Western Illinois University at Macomb, and on collaborating farmers' fields.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. In 1991 and 1992, investigators at Western Illinois University identified and assessed two computer models suitable for analyzing the types of decisions that farmers need to make a sustainable agriculture program. A computer program from the Soil Conservation Service, called Cost and Return Estimator, or CARE, was selected and used to prepare a sample budget for a cooperating farmer to help him analyze his farming system. Another resource analysis program, PLANETOR, and is now being used to assist farmers in making management decisions.

In 1992 researchers studied the microbial populations associated with corn roots on the benchmark and adjacent conventional farms. Bacterial isolates have been identified from the pesticide-free soils which may have potential for use as biological control agents for certain corn pathogens.

Research with less-than-label rates of herbicides indicated that at least two herbicides, Canopy and Lorox Plus, hold promise for effective control when used at less than recommended amounts. Hygroscopic starch additives did not significantly increase herbicide effectiveness. Starch formulations that are more compatible with the herbicide chemistry will be evaluated further.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. Researchers believe it will require up to six more years to complete this work.

RURAL HOUSING NEEDS, NEBRASKA

Mr. DURBIN. Please provide a description of the work that has been done under the rural housing needs program to date and the period of the existing contract.

Dr. JORDAN. The rural housing needs program will support research to compare selected housing affordability indexes in rural areas. Based on these analyses, improved affordability indexes will be developed for use in examining the housing status of families in rural areas and to manage rural housing programs. The fiscal year 1993 proposal has been received and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant begins in fiscal year 1993 and the appropriation for fiscal year 1993 is $80,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research will be conducted at the University of Nebraska with the University of Wisconsin as a subcontractor.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. This is a new project which will compare and contrast alternate housing affordability indexes using both national and State data.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1994.

RURAL POLICIES INSTITUTE

Mr. DURBIN. Please provide a description of the work that has been done under the Rural Policies Institute program to date and the period of the existing contract.

Dr. JORDAN. A consortium of three universities receives this grant. The purpose of the consortium is to develop methods and data to estimate impacts of current and alternative policies on the economic vitality of rural people and places on both a regional and national basis. Much of the first year's work was devoted to strategic planning, development of appropriate data bases, and the creation of appropriate organizational linkages among the faculty and administrators of the three States. These efforts continue. Operational research to select a number of "typical" or "representative" rural communities to be used as test sites for policy analysis is also advancing and should be completed this year. Substantive research in several policy areas is in the formulative stage, and new studies will be launched continuously through the course of the existing fiscal year 1992 grants which terminate between January 1994 and July 1996. The proposal for research to be conducted under the fiscal year 1993 appropriations has been requested but not received.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by these grants began in fiscal year 1991 and the appropriation for fiscal year 1991 was $375,000. The fiscal year 1992 appropriation was $525,000. The fiscal year 1993 appropriation is $692,000. A total of $1,592,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of Missouri, the University of Arkansas, and the University of Nebraska.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The first year's accomplishments lie mainly in the development of an appropriate organizational structure and operational procedures to make the policy analysis work. Through the use of typical community analyses, the consortium will provide estimates of the impacts of programmatic proposals prior to their implementation and funding. This primary analysis will require a concentrated database and input from experts outside the three institutions involved.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate research will be completed in 1996.

RUSSIAN WHEAT APHID

Mr. DURBIN. Please provide a description of the work that has been done under the Russian wheat aphid program to date and the period of the existing contract?

Dr. JORDAN. This project has led to implementation of management strategies of Russian Wheat Aphid. Aphid traps are being used to predict pest outbreaks and regional newsletters are mailed out to alert producers. Methods of sampling and monitoring population levels have been developed so that producers can efficiently control the pest. Sources of resistant wheats and barleys have been discovered and bred into improved lines. The first resistant varieties will be released for commercial sale in 1994, with at least three more varieties to be released in 1995. Predators and parasites of Russian wheat aphid are being released throughout the western and southwestern United States. Evaluations of resultant control are being made.

The fiscal year 1992 grants terminate between February 1993 and March 1994. The fiscal year 1993 proposals have been requested and received from the University of Idaho, Oregon State University and Washington State University. The proposals are being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $100,000; fiscal year 1990, $346,000; fiscal year 1991, $350,000; and fiscal years 1992 and 1993, $437,000 per year. A total of $1,670,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Washington State University, Oregon State University, University of Idaho, University of California, and Colorado State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Solutions to the Russian wheat aphid are in sight. Resistant commercial varieties will begin coming available in 1994. This unique type of resistance makes maximal use of other methods of control such as biological control, thus extending the effective life of these resistance germplasms. More and more biological control agents are being discovered, released, and evaluated.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. It is anticipated that the work may be completed in fiscal year 1994. Agricultural Research Service also conducts Russian wheat aphid research and will devote $2.5 million to this work in fiscal year 1993.

SAFFLOWER RESEARCH, NORTH DAKOTA AND MONTANA

Mr. DURBIN. Please provide a description of the work that has been done under the safflower research program to date and the period of the existing contract.

Dr. JORDAN. The overall objective and expected final outcome of this safflower research is to enable the Northern Great Plains farmers to maintain and expand production of safflower as an alternative crop to cereal grains. Research is being conducted on safflower production for oil and meal, and utilization research in food and non-food systems. The fiscal year 1992 grants support research through July 1994. The fiscal year 1993 grants have been awarded and support research through June 1995.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1990, $247,000; fiscal year 1991, $248,000; and fiscal years 1992 and 1993, $250,000 per year. A total of $995,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the Agricultural Experiment Stations of North Dakota and Montana.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Research is being conducted on the interrelated areas of production systems research and product enhancement research. Product enhancement research have been principally to develop safflower germplasm for enhanced oil and meal qualities and agronomic adaptability for commercial production in the northern Great Plains. This research includes the evaluation of the current safflower world collection and related carthamus species to identify new genetic material having enhanced oil and meal qualities for food, feed, and/or industrial uses.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. In order to complete the objectives of this safflower research, indications are that work may be completed in six years.

SEAFOOD HARVESTING, PROCESSING, AND MARKETING, MISSISSIPPI

Mr. DURBIN. Please provide a description of the work that has been done under the seafood harvesting, processing, and marketing program to date and the period of the existing contract.

Dr. JORDAN. Research has been conducted on the evaluation of surimi made from Gulf menhaden, utilization of off-flavored catfish, and utilization of mince from commercial catfish frames. Baseline data is being compiled to aid in establishing guidelines for excess water addition to processed catfish products. The fiscal year 1992 grant supports work through September 1993. The fiscal year 1993 proposal has been received, is being reviewed and will support research through June 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1990 and the appropriation for fiscal year 1990 was $368,000. The appropriations for fiscal years 1991, 1992, and 1993 were $361,000 per year. A total of $1,451,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research is being conducted by scientists in the Departments of Food Science and Technology and Agricultural Economics of the Mississippi Agricultural and Forestry Experiment Station at Mississippi State University and at the Coastal Research and Extension Center, Seafood Processing Laboratory, in Pascagoula, Mississippi.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. An average color surimi with average gel strength has been made consistently from Gulf menhaden. Some of this product was shipped to a commercial surimi manufacturer for evaluation and addition into final products. Tests showed that washing mince from off-flavored catfish to remove deleterious flavors may be a technically feasible way for using off-flavored fish. Several processors are believed to be using the process developed by the researchers for recovering mince from catfish frames to use for various patties, croquettes, and stuffed fish products.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The initial proposal requested funding through fiscal year 1992. Researchers expect that continued support will be needed beyond fiscal year 1993 to apply the findings of the basic research from the project to solving problems and developing products and economic opportunities.

SEAFOOD RESEARCH, OREGON

Mr. DURBIN. Please provide a description of the work that has been done under the program to date and the period of the existing contract.

Dr. JORDAN. The overall goals of the project are to assist the West Coast seafood industry in developing advanced level seafood processing capabilities. Research will focus on characterizing and controlling the enzyme system that causes tissue softening of Pacific whiting, the largest harvestable biomass off the West Coast of the contiguous United States. Results from these studies will allow

development of value-added products that have substantially higher profit margins and present a wide range of market opportunities. The fiscal year 1993 proposal has been requested, is being reviewed, and will support research through January 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant begins in fiscal year 1993 and the appropriation for fiscal year 1993 is $327,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research will be conducted at the Oregon State University Seafood Laboratory in Astoria.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. There are no accomplishments to report since the project was first funded in 1993. However, researchers believe that this work will advance the coastal seafood industry.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. It is estimated that the project objectives can be accomplished in three years.

SMALL FRUIT RESEARCH

Mr. DURBIN. Please provide a description of the work that has been done under the small fruit program to date and the period of the existing contract.

Dr. JORDAN. The objectives of this grant are to improve the production and quality of small fruits in the Pacific Northwest through research on cold hardiness, breeding and genetics, and pest control. The fiscal year 1992 grant supports research through August 1994. For fiscal year 1993, separate grants are going to be awarded to the Oregon, Washington, and Idaho Agricultural Experiment Stations. Fiscal year 1993 grants have been requested, but not yet received from Oregon and Idaho. The Washington grants has been received and is being processed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991 and the appropriation for fiscal year 1991 was $125,000. The fiscal years 1992 and 1993 appropriation is $197,000 per year. A total of $499,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research is being conducted at Oregon State University, Washington State University and the University of Idaho with Oregon State University as the lead university.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Work has started in Oregon on IPM control of spider mites, using DNA fingerprinting to identify grape clones and rootstocks, virus indexing of germplasm and better color stability of processed strawberries. Work is continuing in Washington on fruit physiology, cold hardiness and culture of grapes; weed control and herbicides for cranberries; cold hardy raspberries; and pest resistant strawberry germplasm. Idaho work continues on postharvest research for better marketability and adapting small fruit crops to high elevation growing conditions.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1996.

SOIL AND WATER RESEARCH, OHIO

Mr. DURBIN. Please provide a description of the work that has been done under the soil and water research program to date and the period of the existing contract.

Dr. JORDAN. The proposal for the research to be conducted has been received and the grant is being processed.

The long-term objective of the research is to describe how and understand why ecosystems behave as they do. The research builds upon long-term studies of Maumee Bay initiated in 1974. The proposed research will test the hypothesis that zebra mussel grazing on phytoplankton holds total phytoplankton density below that which would occur if the density was limited by phosphorus. The role of soil erosion and the resulting sediment in the ecosystem is part of the research to be conducted. The proposed studies will provide information on the fate and effects of soil erosion sediment on the water resources of Lake Erie.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant begins in fiscal year 1993 and the appropriation for fiscal year 1993 is $240,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research is being conducted by faculty in the Biology Department at the University of Toledo in Ohio. The field location of the study is the Maumee Bay on Lake Erie.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. There are no accomplishments to report since funding for the project began in 1993.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1994.

SOUTHWEST CONSORTIUM FOR PLANT GENETICS AND WATER RESOURCES

Mr. DURBIN. Please provide a description of the work that has been done under the Southwest Consortium for plant genetics and water resources program to date and the period of the existing contract.

Dr. JORDAN. New Mexico State University, Los Alamos National Laboratory, Texas Tech University, the University of Arizona and the University of California at Riverside entered into a cooperative interdisciplinary research agreement constituted as the Southwest Consortium on Plant Genetics and Water Resources to facilitate research relevant to arid and semi-arid adaptation. The overall goal of the Consortium is to bring together multidisciplinary scientific teams to develop innovative advances in plant biotechnology and related areas to bear on agriculture and water use in arid and semi-arid regions. The fiscal year 1992 grant supports research

through September 1993. The grant proposal for fiscal year 1993 has been received and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1986, $285,000; fiscal years 1987–89, $385,000 per year; fiscal year 1990, $380,000; and fiscal years 1991, 1992, and 1993 $400,000 per year. A total of $3,020,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted by a consortium of institutions comprised of New Mexico State University, Los Alamos National Laboratory, Texas Tech University, University of Arizona, and University of California at Riverside. New Mexico State University is the lead institution.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The Consortium has discovered a protein that makes plants more resistant to water stress; a gene that blocks a metabolic pathway and as a result, makes the plant more healthy; identified a genetic marker for salt tolerance; and compared the genetic systems of wild plant species for differences in drought response. Also, one research team has cloned a gene from alfalfa that controls an important biosynthetic pathway; while another worked out the complex metabolism of salt tolerance in resistance plant types.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. It is anticipated that the work may be completed in two more years.

SOYBEAN BIOPROCESSING, IOWA

Mr. DURBIN. Please provide a description of the work that has been done under the soybean bioprocessing program to date and the period of the existing contract.

Dr. JORDAN. Research continues to progress on identifying new genes or gene combinations that alter the fatty acid composition or glyceride structure of soybean oil, incorporating the new genetic systems into commercially acceptable cultivars, and producing sufficient seed of the new cultivars for large-scale oil extraction, refining, and product evaluation. The research efforts are increasing genetic variation in soybeans, will lead to the development of new cultivars, and will yield oils that can be used in broad food and industrial applications in the U.S. and abroad. The fiscal year 1992 grant supports work through April 1993. The fiscal year 1993 grant proposal has been received, is being reviewed and will support research through December 1993.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991 and the fiscal year 1991 appropriation was $200,000. The appropriation for fiscal year 1992 was $275,000. The fiscal year 1993 appropriation is $328,000. A total of $803,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Iowa State University and various experimental farms throughout Iowa. During the winter, work that does not involve measurement of yield is done in cooperation with the University of Puerto Rico.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Major progress was made during 1992 in the development and commercialization of soybean cultivars with reduced total saturates, elevated palmitate, or reduced linoleate. Progress also was made in designing breeding strategies that will improve the efficiency and effectiveness of developing cultivars with modified fatty acyl contents.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1995.

SOYBEAN CYST NEMATODE, MISSOURI

Mr. DURBIN. Please provide a description of the work that has been done under the soybean cyst nematode program to date and the period of the existing contract.

Dr. JORDAN. Research on soybean cyst nematode is focused on incorporating or enhancing high levels of resistance to the pest in soybean cultivars. Over 10,000 plant introductions from the world collection of soybean germplasm have been tested for resistance to soybean cyst nematodes. Forty-five lines have been identified as resistant to one or more strains of the nematode and one line, PI 437654, is resistant to all known strains in the United States. These resistant lines are utilized in breeding programs to develop resistant soybean cultivars. The fiscal year 1992 award supports research through March 1994. The fiscal year 1993 proposal has been requested but has not yet been received.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1979, $150,000; fiscal years 1980–1981, $250,000 per year; fiscal year 1982, $240,000; fiscal years 1983–1985, $300,000 per year; fiscal years 1986–1989, $285,000; fiscal year 1990, $281,000; fiscal year 1991, $333,000; and fiscal years 1992, and 1993, $359,000 per year. A total of $4,262,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. This research is being conducted at the Missouri Agricultural Experiment Station.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The soybean breeding program has succeeded in transferring the nematode resistance in PI 437654 to the new soybean variety "Hartwig". This cultivar is now commercially grown and remains resistant to all known strains of cyst nematode, as well as to the root knot nematode. Genetic studies have indicated that inheritance of this resistance is complex and controlled by several genes. Several alternative resistant genes in other soybean lines have been identified and are being positioned to supplement nematode resistance in "Hartwig" or in other varieties. Two additional soybean cultivars resistant to soybean cyst nematode were

also released. The effect of crop rotations to reduce cyst nematode infestations and increase soybean yield is also under investigation.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. According to the researchers, to more fully understand the biology of the pest and develop alternative cultivars and management strategies will require additional study through fiscal year 1998.

STEEP II—WATER QUALITY IN PACIFIC NORTHWEST

Mr. DURBIN. Please provide a description of the work that has been done to date under the STEEP II—Water Quality in the Pacific Northwest program and the period of the existing contract.

Dr. JORDAN. STEEP II, which began in 1991, is the second phase of the research and technology transfer project entitled, "Solutions to Environmental and Economic Problems". Field research projects evaluate the integrated effects of planting systems, deep tillage, pest management, nutrient management, crop cultivars, and crop rotation on crop yields, profitability, and erosion and water quality control for different landscape positions and crop management units. Management systems for different agroecosystems in the Pacific Northwest states are transferred to growers. Efforts are underway to develop and validate models and expert systems useful to both producers and scientists for predicting outcomes and managing cereal production systems with emphasis on natural resource conservation and efficient crop production. The 1992 grants terminate between April 1994 and August 1995. The 1993 grants are currently under preparation and review.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991, and the appropriations for fiscal years 1991, 1992, and 1993 are $980,000 per year. A total of $2,940,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The work under STEEP II will be done at field research sites and laboratories in Idaho, Washington, and Oregon by scientists of the State Agricultural Experiment Stations. Scientists from the United States Department of Agriculture Agricultural Research Service and the Cooperative Extension Services in each of the States also participate in some projects.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The research and technology transfer activities conducted under STEEP II has provided Pacific Northwest growers with profitable farming systems that meet the 1995 conservation compliance deadline in the Farm Bill. The steep Palouse slopes allow fall-applied chemicals to move deeply into the soil and long distances down slope. A new grower-developed soil fertility and tillage system shows promise for increasing surface residues, improving water storage and improving soil quality.

New cereal crop breeding and cultural practices research has reduced crop damage from leaf spot disease by 10 percent. Breeding

experiments have identified wheat genotypes with superior resistance to root rot.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The original STEEP program was a 15-year program, initiated in 1976 and completed in 1991. The new STEEP II program was started in 1991, with the first phase planned to extend for five years.

STONE FRUIT DECLINE, MICHIGAN

Mr. DURBIN. Please provide a description of the work that has been done under the stone fruit decline program to date and the period of the existing contract.

Dr. JORDAN. Research supported by fiscal year 1992 funds was aimed at several problem areas. Futuristic orchards are designed to include rain shelters and trellises for fresh market fruit. Surveys to identify pests and diseases and to assess their relative impact are conducted. Physiological stress due to combinations of cold temperatures, drought and/or disease is evaluated as are optimal environments for fruit storage. The fiscal year 1992 grant supports research through September 1993. The fiscal year 1993 grant is being reviewed and will support research through September 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1985, $300,000; fiscal years 1986–1989, $285,000 per year; fiscal year 1990, $281,000; and fiscal years 1991, 1992, and 1993, $283,000 per year. A total of $2,570,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. This research is being conducted at the Michigan Agricultural Experiment Station.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Research continues to address problems and variables related to fruit tree decline. An economic feasibility model for the production of sweet cherries was developed to determine if covering trees from rain that cracks fruit could be profitable. Prototype shelters were constructed at two test sites. The severe negative effect of tomato ringspot virus on the yield of stonefruit was documented. Growers have been warned to prevent spread of the virus by planting clean stock and by eradicating the nematode vector. It also appears that two Pseudomonas species and low soil pH are the major players in sweet cherry decline. The role of groundcovers, specifically grass, in the spread of leafhoppers carrying X-disease mycoplasma has been documented and the use of other types of groundcover are being investigated. Development of cold hardy peach cultivars tolerant to bacterial canker is progressing. A plant introduction from Russia may have higher tolerance to canker than the major peach varieties grown in Michigan. A quick and reliable method was developed for screening peach cultivars for susceptibility to canker. The effects of poor physical handling and poor temperature management in contrast to proper han-

dling suggests improvements to extend postharvest life of sweet cherries.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The researchers anticipate that the immediate research objectives could be completed in fiscal year 1995.

SUBIRRIGATION RESEARCH, MICHIGAN

Mr. DURBIN. Please provide a description of the work that has been done under the subirrigation research program to date and the period of the existing contract.

Dr. JORDAN. A state-of-the-art subirrigation and rainshelter facility has been installed. A comprehensive study of the homogeneity of the research site has been completed. The research focuses upon development of subirrigation technology and management practices that will reduce the negative impacts of agricultural chemicals on water resources while sustaining productivity. The fiscal year 1992 grant supports research through September 1993. The fiscal year 1993 grant has been received and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1990, $62,000; fiscal year 1991, $262,000; fiscal year 1992, $531,000; and fiscal year 1993, $531,000. A total of $1,386,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research is being conducted by Michigan State University at a site in Tuscola County near Unionville, Michigan.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. A research facility has been constructed. A team of twelve research scientists are initiating studies on the fate and transport of agricultural chemicals, biological dynamics of the soil system and the economics of production of field crops and vegetables.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The investigators anticipate that the initial phase of the research may be completed in five years.

SUNFLOWER INSECTS, NORTH DAKOTA AND SOUTH DAKOTA

Mr. DURBIN. Please provide a description of the work that has been done under the sunflower insects program to date and the period of the existing contract.

Dr. JORDAN. The North Dakota and South Dakota Agricultural Experiment Stations continue short and long term research to manage sunflower pests. The fiscal year 1992 grants support research through March 1995 and July 1993, respectively. The fiscal year 1993 grants support research through March 1996 and July 1994, respectively.

Mr. DURBIN. How long has this work been under way and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1982, $72,000; fiscal year 1983, $80,000; fiscal

years 1984–1985, $150,000 per year; fiscal years 1986–1989, $190,000 per year; fiscal year 1990, $188,000; fiscal year 1991, $194,000; and fiscal years 1992 and 1993, $200,000 per year. A total of $1,994,000 has been appropriated. Beginning in fiscal year 1986, approximately 25 percent of the funds have been allocated to South Dakota.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. This research is being carried out at the North Dakota and South Dakota Agricultural Experiment Stations.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The research programs in North Dakota and South Dakota provide a major regional emphasis on the management of sunflower insect pests. The program in North Dakota is studying the key insect pests of sunflower and providing extension publications on updated approaches to the management of insect pests of sunflower including varietal resistance and planting dates. Insects under current investigation include gray sunflower seed weevil, red sunflower seed weevil, and sunflower midge. South Dakota is focusing on a transformation technique for incorporating alien DNA with desirable traits into the sunflower plant.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. In North Dakota, a new three-year phase of research is identified each year. The South Dakota program would require an additional three-years of funding to complete the current phase.

SUSTAINABLE AGRICULTURE AND NATURAL RESOURCES, PENNSYLVANIA

Mr. DURBIN. Please provide a description of the work that has been done under the sustainable agriculture and natural resources program to date and the period of the existing contract.

Dr. JORDAN. CSRS has requested the university to submit a grant proposal that has not yet been received. Pennsylvania State University has recently conducted a local competitive grants program to finalize the exact nature of the research. The topics that will be covered include research on nutrient cycling in vegetable production, development and evaluation of new on-farm composting technology, and advanced IPM technology for Pennsylvania apple production.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through 1993?

Dr. JORDAN. The work supported by this grant begins in fiscal year 1993 and the appropriation for fiscal year 1993 is $100,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Reseach will be conducted at Pennsylvania State University and cooperators throughout Pennsylvania.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The project is beginning in 1993. It is designed to enhance the economic viability of Pennsylvania agriculture in an environmentally sound manner.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. This will not be known until the proposal is received.

SUSTAINABLE AGRICULTURE SYSTEMS, NEBRASKA

Mr. DURBIN. Please provide a description of the work that has been done under the sustainable agriculture systems program to date and the period of the existing contract.

Dr. JORDAN. The fiscal year 1992 grant supports research through March 1993. The proposal has been received and is being reviewed. The global objective of the 1993 project is to investigate and develop management strategies that will increase the biological and economic efficiency of farming systems that integrate cropping and livestock production on farm or in a watershed. A second broad objective of the project is to organize and locate five regional research projects in locations where they can provide sites for educational activities, for college and younger students, for adult extension audiences, and others.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through 1993?

Dr. JORDAN. The work supported by this grant begins in fiscal year 1992 and the appropriation for fiscal year 1992 and 1993 is $70,000 per year. A total of $140,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Reseach is being conducted at the University of Nebraska.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The site for the research was developed near Mead, Nebraska, and a team of 25–30 scientists began to work on the project. The research focuses on the development of management strategies that increase the biological farming systems that integrate crop, livestock and forest production at the farm and watershed levels.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that the work will be completed in fiscal year 1994. It is anticipated that this 3-year project will catalyze other sources of long-term funding.

SWINE RESEARCH, MINNESOTA

Mr. DURBIN. Please provide a description of the work that has been done under the swine research program to date and the period of the existing contract.

Dr. JORDAN. The research addresses disease-oriented research which studies basic and applied problems related to important and emerging diseases of swine; and a production-oriented research which will address questions of production problems and methods that impact on the biological and economic performance of the industry. Individual projects developed by faculty are subject to a university peer review process to establish funding priorities. The fiscal year 1992 grant supports research through June 1993. The fiscal year 1993 grant proposals have been received and are under review.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992 and the appropriation for fiscal years 1992 and 1993 is

$140,000 per year. A total of $280,000 has been appropriated. CSRS funds have been matched by $119,766 from the Minnesota Pork Producers Association and $36,000 from the National Pork Producers Council.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of Minnesota Swine Research Center.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The grant supports several research projects aimed at the development of new environmental management practices, improved procedures related to use of medicated early weaning practices in pigs, and the assessment of new nutrient management practices in lactating sows and growing pigs.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The efforts are proposed to be completed in fiscal year 1996.

TCK SMUT

Mr. DURBIN. Please provide a description of the work that has been done under the TCK smut program to date and the period of the existing contract.

Dr. JORDAN. Special Research Grant funds supported a cooperative research program on TCK Smut of wheat involving State Agricultural Experiment Station projects in Idaho, Montana, Oregon, Utah, and Washington. Collaborative work involved smut resistance genetics and breeding in soft white winter wheat and hard red winter wheat, using both conventional and molecular genetics techniques. Research was also concerned with developing strategies for smut identification, diagnosis, destruction and prevention. Cooperators continued research on wide hybridizations between wheat and other monocot plant species and genera, with the goal of obtaining new sources of smut resistance. Basic studies on mechanisms of resistance were continued. Modest effort has dealt with testing of new fungicides in smut fungus control. The fiscal year 1992 grants terminate between March 1993 and March 1995. The fiscal year 1993 grant subproposals are being reviewed and will support research through May 1994 and March 1995.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1982, $288,000; fiscal years 1983–1985, $361,000 per year; fiscal year 1986, $343,000; fiscal years 1987–1989, $193,000 per year; fiscal year 1990, $247,000; and fiscal years 1991, 1992 and 1993, $250,000 per year. A total of $3,290,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. This research is being conducted at State Agricultural Experiment Stations in Idaho, Montana, Oregon, Utah, and Washington.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Results using gamma irradiation to eliminate viable TCK inoculum from wheat indicate that germination of spores is

effective at doses where only minor effects on milling and baking quality are observed. Electron beam irradiation was found to be effective for post-harvest control of the wheat seed with no detrimental effects to the seed observed at irradiation levels sufficient to kill the fungus. Research into the identification and development of wheat cultivars containing resistance to the fungus resulted in the identification of cultivars which retain their resistance when grown as plantlets from tissue culture. Field studies have shown that very early or late seeding of winter wheat controlled TCK without the use of fungicides. Breeding efforts to obtain TCK resistance by new inter- and intra-specific crosses have resulted in lines which have excellent resistance to smut and may provide a new genetic source of resistance. A simple, rapid DNA-based diagnostic technique was developed to differentiate TCK from other *Tilletia* species. This is a new, novel, and potentially powerful approach to identifying species of smuts. Work on the production of intergeneric hybridizations involving wheat and other grasses will continue with the objective of incorporating new sources of TCK resistance into wheat cultivars grown in the field. Lines emerging from the various wide hybridization procedures will be evaluated for smut resistance in artificially inoculated smut nurseries.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. Scientists have not identified a specific termination date.

TROPICAL AND SUBTROPICAL RESEARCH

Mr. DURBIN. Please provide a description of the work that has been done under the tropical and subtropical research program to date and the period of the existing contract.

Dr. JORDAN. CSRS is operating the program with the advice, planning, coordinating and assistance of the Caribbean Basin Administrative Group—CBAG and the Pacific Basin Administrative Group—PBAG. State Agricultural Experiment Stations that are members of CBAG are Florida, Puerto Rico, and the Virgin Islands; members of PBAG are Hawaii and Guam.

Non-member institutional interests are represented by the Executive Director of the Southern Region Agricultural Experiment Station Directors, who is a member of CBAG, and the Executive Director of the Western Region Agricultural Experiment Station Directors, who is a member of PBAG. The Agricultural Research Service has representation on CBAG and PBAG.

Funds for the program are divided equally between the two Basin Administrative Groups. The Research objective of the program is to improve the agriculture of many of the subtropical and tropical parts of the United States. Special research grants have been awarded for research on controlling insect, disease and weed pests of crops; increasing the production and quality of tropical fruits, vegetables and agronomic crops; promoting increased beef production through development of superior pastures; detection of bovine anaplasmosis and heartwater diseases of cattle; better use of land and water resources; and potential for growing new specialty crops.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The operation of the tropical and subtropical research program was transferred from ARS to CSRS, with CSRS funding being first provided in fiscal year 1983. Funds in the amount of $2,980,000 per year were appropriated in fiscal years 1983 and 1984. In fiscal year 1985, $3,250,000 was appropriated. In fiscal years 1986, 1987, and 1988, $3,091,000 was appropriated each year. $3,341,000 was appropriated in fiscal year 1989. The fiscal year 1990 appropriation was $3,299,000. The fiscal years 1991, 1992, and 1993 appropriations are $3,320,000 per year. A total of $35,083,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. This research is being conducted in Florida, Puerto Rico, Virgin Islands, Hawaii, and Guam.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. In fiscal year 1992, a total of 84 grants were awarded with 43 grants being awarded through CBAG and 41 grants being awarded through PBAG. Grants were awarded for research mainly in the areas of tropical animal and crop pest protection and productivity. Some examples of new research being funded are virus resistance in lettuce using molecular markers, properties of chlorophyll, biotechnology approaches to control orchid viruses, taro acidity, managing resistance to biopesticides, tropical legumes for green manure crops, micro irrigation, control of tomato spotted virus, forage utilization by beef cattle, using urea for cattle forage feeding, bioherbicides for nutsedge, DNA probes for papaya diseases, heat stress of dairy cattle, developing non-Zebu cattle for hot climates, and developing effective postharvest shipping methods for vegetables.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate the work will be completed?

Dr. JORDAN. The scientists have not established a termination date.

URBAN PESTS, GEORGIA

Mr. DURBIN. Please provide a description of the work that has been done under the urban pests program to date and the period of the existing contract.

Dr. JORDAN. The research focuses on household and structural pest problems and specifically termite and ant pests. The research will assess the biological activity of alternative and conventional control agents, evaluate efficacy and delivery systems and monitor the environmental fate of these control agents. The fiscal year 1992 grant supports research through March 1993. The fiscal year 1993 grant will support research through March 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant in fiscal years 1991, 1992, and 1993 was $76,000 per year. A total of $228,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of Georgia.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Current research emphases are on termites and ants. Termites were found to preferentially attack weathered wood to new wood. Termites avoided or fed at low rates on high-resin white pine lumber. The first record was obtained of the subterranean termite species *Reticultitermes hageni* infesting a structure. Termites can be killed by fungus preparations as an alternative to chemical termiticides. Some viruses are also infectious to subterranean termites. A number of chemical termiticides treated successfully protected wood sites from termite invasion at concentrations of 50 parts per million. Subterranean termites will accept artificial food sources which is important to the development and commercialization of a bait control strategy. Research on Argentine ants has been less intense than termite research. Bait toxicant formulations are being tested and the critical problem is bait acceptance.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The current objectives on termites and ants would require an additional two years to complete.

WATER CONSERVATION, KANSAS

Mr. DURBIN. Please provide a description of the work that has been done under the water conservation program to date and the period of the existing contract.

Dr. JORDAN. CSRS has requested the University to submit a grant proposal that will be submitted this month.

The proposed research is designed to increase the technical and economic efficiency of water use by crops grown in Kansas under water efficient irrigation methods.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant begins in fiscal year 1993 with an appropriation of $94,000. The total funds appropriated are $94,000.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research will be conducted at Kansas State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. There are no accomplishments to report since funding for the project began in 1993.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in 1997 after five years of data collection.

WATER CONSERVATION, NEVADA

Mr. DURBIN. Please provide a description of the work that has been done under the water conservation program to date and the period of the existing contract.

Dr. JORDAN. Work under the Water Conservation project in Nevada was initiated in 1992. The research is being conducted on

land made available by the city of North Las Vegas. Site preparation and planting of grass has been initiated. A meteorological network has been established and an evapotranspiration feedback system completed. Soil samples will be taken regularly to monitor the salinity level as irrigation with wastewater is applied. The physiological response of tall fescue and bermudagrass to varying levels of salinity will be studied.

The fiscal year 1992 grant supports research through September 1995. The 1993 grant proposal has been received and is being processed for award.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992. Funds appropriated for fiscal years 1992 and 1993 were $200,000 per year. A total of $400,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research is being conducted at the University of Nevada, Las Vegas, in cooperation with the city of North Las Vegas.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Preparations for the field research have been completed and the grass test crop is being established. The soil characterization has been completed and the evapotranspiration studies initiated. Soil sampling, irrigation, weather monitoring and plant observations will proceed on schedule. Research results and educational materials developed by the project will enable urban water managers and other users to become better stewards of the water resources and to implement improved Best Management Practices—BMPs.

work anticipate that the work will be completed?

Dr. JORDAN. The initial plan was developed for three years beginning in 1992.

WATER MANAGEMENT, ALABAMA

Mr. DURBIN. Please provide a description of the work that has been done under the water management program to date and the period of the existing contract.

Dr. JORDAN. Research currently underway in the Water Management in Alabama grant includes: the development of effective methods for recycling paper mill, yard, and other agricultural wastes through application to soils, and the determination of their effects on water quality; studies of the nitrogen dynamics in carbon dioxide enriched agroecosystems, and to determine the effects of these systems on water quality and water-use efficiency; the determination of the interactions between forest species, silvicultural practices, and harvesting techniques that affect the quality of Southeastern forest ecosystems; and the development of recommendations for policies and programs to effectively manage the short- and long-term effects of drought on agriculture and other sectors.

The fiscal year 1992 grant supports research through August, 1994. The funds allocated in 1992 were used to collect additional data on the proper disposal of poultry litter and to investigate irrigation practices and efficiency of water utilization. The Cooperative

State Research Service has requested a proposal for the 1993 funds, which is currently under preparation by Auburn University.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $300,000; fiscal year 1990, $395,000; fiscal year 1991, $397,000; and fiscal years 1992 and 1993, $398,000 per year. A total of $1,188,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Auburn University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Results of previous research have demonstrated that the establishment of irrigation districts is feasible in Alabama. Mechanisms exist for cost-sharing the development and management of irrigation districts. Research has shown that the large amount of water flowing over the surface of Alabama can be captured and used for irrigation. This water would be harvested and stored during the rainy season when streams and rivers are most likely to overflow. There would be little impact on reducing the water available downstream from the collection site or on water use by neighboring states. Other research under this grant has clearly shown that long-term application of broiler litter results in the accumulation of nutrients in the soil all the way to the bedrock in the Sand Mountain Region. This accumulation of nutrients, and particularly of heavy metal contaminants, may impact the quality of groundwater used by rural Alabama for household use.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. It is anticipated that the research will be completed during fiscal year 1996.

WATER QUALITY

Mr. DURBIN. Please provide a description of the work that has been done under the water quality program to date and the period of the existing contract.

Dr. JORDAN. The Cooperative State Research Service, as a part of the coordinated program on water quality, is supporting two types of efforts with the fiscal year 1993 funding: a nationwide program of competitively-selected Special Research Grants and operation of five Management Systems Evaluation Areas under the Midwest Initiative on Water Quality to conduct research at 10 locations throughout the Corn Belt to better understand and evaluate the impacts of various agricultural production systems on water quality. The Midwest Initiative is jointly conducted by the Cooperative State Research Service, State Agricultural Experiment Stations, and the Agricultural Research Service, in cooperation with the United States Geological Survey, Environmental Protection Agency, Extension Service, Soil Conservation Service, and other federal and state agencies.

In fiscal year 1992, 410 proposals were received in the national Special Research Grants Program. Of these, 79 or 19 percent were recommended for funding by merit review panels, with awards ranging from $37,620 to $225,000 for total periods of two or three

years. Response to the Request for Proposals for the fiscal year 1993 Special Grants Program in Water Quality resulted in submission of 239 proposals which are currently undergoing peer review.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work under the Water Quality Program began in fiscal year 1990 with an appropriation of $6,615,000. The fiscal year 1991 appropriation was $8,000,000; the 1992 appropriation was $9,000,000; and the 1993 appropriation is $8,950,000. A total of $32,565,000 has been appropriated for Special Research Grants on water quality. In addition, $3 million was appropriated in fiscal year 1989 for groundwater research.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The awards under the national competitively-selected Special Research Grants Program in FY 1993 may be made in any State, and are based on selected research problem areas. The Management Systems Evaluation Areas of the Midwest Initiative on Water Quality are headquartered in Iowa, Minnesota, Missouri, Nebraska, and Ohio, with satellite locations in North Dakota, South Dakota, and Wisconsin.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The water quality research program is developing new tools and new management systems to assist farmers in reducing pollution while maintaining productivity. Accomplishments will be provided for the record.

[The information follows:]

1. *Prescription Farming*—By matching fertilizer use to crop requirements for different soils in a field, the potential for nutrient leaching is reduced. For dryland wheat and barley, matching fertilizer applied to crop requirements and the soil supply, a benefit of from $5 to $15 per acre can be realized.

2. *Nitrate Reduction with Cover Crops*—Cover crops planted after harvest of the agronomic crop will reduce the quantity of nitrate available to leach to the groundwater. Cover crops have been shown to capture more than 100 pounds of nitrate per acre.

3. *Irrigation and Nitrate Leaching*—The most cost effective method of reducing nitrate leaching in the surface water—flood—irrigation areas of the Pacific Northwest appears to be reduced water applications. In the Midwest, application of nitrogen through center pivot systems—fertigation—based upon chlorophyll content and nitrate level in the plant is reducing the nitrate leaching to groundwater.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The principal researchers have made excellent progress during three years of study toward understanding the basic principles of groundwater pollution and remediation. Implementation of recommended pollution prevention or remediation practices and evaluation of their effectiveness requires many years. The impact of farming practices upon groundwater quality may require 15 to 20 years to obtain definitive results. The principal researchers anticipate that another 5 to 10 years are needed to complete the work in progress.

WEED CONTROL, NORTH DAKOTA

Mr. DURBIN. Please provide a description of the work that has been done under the weed control program to date and the period of the existing contract.

Dr. JORDAN. The project is designed to reduce the environmental concerns caused by the extensive usage of herbicides for weed control and provide growers with environmentally safe weed control systems. The present project stresses research on cropping systems for weed control; weed biology emphasizing kochia and Russian thistle seed production and survival, growth requirements, and resistance to herbicides; and efficient herbicide usage with adjuvants and application methods. The fiscal year 1992 grant supports research through March 1996. The grant for fiscal year 1993 has been received and is being processed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992 and the appropriation for fiscal years 1992 and 1993 is $500,000 per year. A total of $1,000,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at North Dakota State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Experiments were established at three locations to determine weed infestations, crop residue on the soil surface, and economic and energy inputs and returns for no-till, conventional till, and sustainable cropping systems. Because kochia seed is believed to survive only 2 or 3 years in soil and seedlings cannot emerge from deep in soil, an experiment was established in an area heavily infested with kochia to determine the time required for eradication using moldboard plow or chisel ploy in a continuous wheat cropping system with complete control each year using herbicides and hand weeding as needed. Research is in progress on the influence of adjuvants on cell transmembrane potential and efficacy of alcohol ethoxylates as adjuvants with herbicides differing in water solubility. Also research is in progress on the antagonism of herbicides by salts in the spray diluent.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. Research is being conducted in a 4-year rotational field studies with 2 cycles needed to provide a broad spectrum of research. Thus, university researchers anticipate that work may be completed in fiscal year 2001.

WHEAT GENETICS, KANSAS

Mr. DURBIN. Please provide a description of the work that has been done under the wheat genetics program to date and the period of the existing contract.

Dr. JORDAN. This project is designed to collect, maintain, evaluate, and document genetic resources of exotic wheat related germplasm; develop genetic and cytogenetic stocks from wild species for use by public, private and international organizations to produce improved wheat cultivars. The grant for fiscal year 1992 supports research through April 1993. The fiscal year 1993 grant is being reviewed and will support research through April 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $100,000; fiscal year 1990, $99,000; fiscal year 1991, $149,000; fiscal years 1992 and 1993, $159,000 per year. A total of $666,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Kansas State University by the Wheat Genetics Resource Center.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. This project has provided supplemental support to state and private contributions to enhance the collection, characterize and catalog genetic material and make it available to wheat researchers. Germplasm evaluation of wild relatives of wheat has been conducted which has identified sources of resistance to major diseases and insect pests of wheat including Russian Wheat Aphid. A major addition of cytogenetic stock of Chinese spring and Chinese sprint was made. Genes were successfully transferred from wild type. Hession fly resistance was identified and progress was made in transferring genes from agropyron species to wheat.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work be completed?

Dr. JORDAN. This project is projected to run for ten years and therefore, would continue through fiscal year 1998.

WHITE MOLD RESEARCH, OHIO

Mr. DURBIN. Please provide a description of the work that has been done under the white mold research program to date and the period of the existing contract.

Dr. JORDAN. This research involves field, greenhouse, and laboratory screening for disease resistance and development of methods to improve screening procedures. The fiscal year 1992 grant supports research through February 1993. The fiscal year 1993 grant has been received and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1992 and the appropriation for fiscal years 1992 and 1993 was $55,000 per year. A total of $110,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the Ohio State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The research supported by this grant is targeted toward the development of soybean lines resistant to the white mold pathogen, *Sclerotinia*. Field, laboratory, and greenhouse inoculation methods have been developed and a good correlation was obtained between the level of fungal growth in cultivars artificially inoculated with spores of the fungus and cultivars becoming infected under natural conditions in the field. A system for the mass production of fungal spores for testing of soybean resistance was developed and infectivity of these spores indicates that they may be suitable for susceptibility evaluations of cultivars. The refined methods of inoculation and screening will be used to evaluate disease resist-

ance of existing cultivars and those obtained through somaclonal variation in tissue culture.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1994.

WILD RICE RESEARCH, MINNESOTA

Mr. DURBIN. Please provide a description of the work that has been done under the wild rice program to date and the period of the existing contract.

Dr. JORDAN. The objectives of the project include variety development; genetic studies of disease and insect resistance, seed dormancy and quality traits; and development of improved breeding techniques. The fiscal year 1992 grant supports research through February 1993. The fiscal year 1993 project has been reviewed and approved to support research through February 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991 and the appropriation for fiscal year 1991 was $50,000. The fiscal years 1992 and 1993 appropriation is $88,000 per year. A total of $226,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of Minnesota.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Seed of a new shattering resistant variety was increased and distributed by Minnesota Crop Improvement Association to growers who had requested it. Seed from natural populations have been collected for crossing with breeding populations. Selections were made for stem sturdiness and short stature and yield. Other experiments are evaluating disease resistance, nitrogen requirement and nondormancy in seeds.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that work may be completed in fiscal year 1996.

WOOD UTILIZATION RESEARCH

Mr. DURBIN. Please provide a description of the work that has been done under the wood utilization research program to date and the period of the existing contract.

Dr. JORDAN. Research is continuing at the Centers for Wood Utilization Research in Michigan, Mississippi, and Oregon. Research in wood utilization develops technologies that extend the renewable resource while providing an increased job base. Additional funds were appropriated in fiscal year 1993 to be awarded competitively. The request for proposals was published in the Federal Register in February, 1993.

The fiscal year 1992 grants terminate between January 1993 and April 1996. The fiscal year 1993 grants are in the award process.

Mr. DURBIN. How long has this work been underway, and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1985, $3,000,000 per year; fiscal year 1986 through fiscal year 1989, $2,852,000 per year; fiscal year 1990, $2,816,000; fiscal years 1991 and 1992, $2,852,000 per year; and fiscal year 1993, $4,153,000. A total of $27,081,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Three universities have principal responsibility for the program. Oregon State University, College of Forestry, has research ongoing in the use of western conifers; Mississippi State University, School of Forest Resources, is working with southern pines; and Michigan State University, Department of Forestry, is coordinating research dealing with Eastern hardwoods in cooperation with researchers in four other universities. The additional funds will be awarded competitively with consideration being given to the University of Maine, College of Forest Resources, and to North Carolina State University, College of Forest Resources.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. There are forty-eight separate projects in various stages of completion. One examined the exporting of treated utility poles. Another project simulated the plywood process. Using this simulation, the management of the mills can test production schemes prior to implementation.

Basic research in the machining of wood materials has shown that electrochemical degradation of the cutting face is one of the causes of machine tool dulling rather than erosion of the cutting face due to abrasion. New tools and new process variables are being applied to machining wood and other materials as a result of this research.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate the work will be completed?

Dr. JORDAN. Current studies terminate in 1997.

WOOL RESEARCH

Mr. DURBIN. Please provide a description of the work that has been done under the wool research program to date, and the period of the existing contract.

Dr. JORDAN. The overall goals for this research are the development of objective measures of wool, mohair, cashmere and other animal fibers to increase profitability of the sheep and Angora goat industries. Specific objectives have included: evaluate and develop measurement techniques for rapid, objective evaluation of wool and mohair; use objective measurements to increase fiber production, quality and value; provide fiber technology capability to aid selection research with sheep and Angora goats; determine the effects of various management, nutritional and preparation treatments on quality and quantity of wool and mohair; further develop and evaluate available technology for scouring, effluent treatment, woolen carding and woolen yarn production; and participate in cooperative research to study the influence of wool and mohair fiber properties and spinning performance. Numerous scientific and

technical papers were published during the past year. The fiscal year 1992 grants terminate between February 1993 and April 1994. The fiscal year 1993 grants have been received and are currently being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from appropriated funds in the amount of $150,000 for fiscal years 1984–1985; $142,000 per year for fiscal years 1986–1989; $144,000 for fiscal year 1990; $198,000 for fiscal year 1991; and $250,000 for fiscal years 1992 and 1993. A total of $1,710,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The research is in progress at the Texas Agricultural Experiment Station, the University of Wyoming and Montana State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The software for the automatic image analysis system has been refined for measuring the average diameter and distribution of animal fibers. Software is also being written to permit rapid, accurate measurement of other fiber properties including: medullation, colored fibers, staple length and crimp. Near infrared reflectance analysis has been used for yield measurement of mohair. Progress toward other objectives includes the evaluation of side samples as a measure of individual fleece yield and fiber diameter; determination of the influence of heritability of different sources of variation in fiber diameter; determination of the effect of britch removal in Rambouillet fleeces on clip fiber diameter and clip diameter variability; and determination of the influence of Australian Merino breeding on fiber diameter, staple length, clean yield and weight.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. It is anticipated that at least five years will be required to complete the current research and to obtain permanent funding from other sources for this research.

WORLD FOOD SYSTEMS, INDIANA AND OHIO

Mr. DURBIN. Please provide a description of the work that has been done under the world food systems program to date and the period of the existing contract.

Dr. JORDAN. The grant funds are used to support a core group of researchers located at Ohio State University which has the following responsibilities: conducts original research that contributes to the successful completion of objectives of the Hatch Act regional project NC–194, titled "The Organization and Performance of World Food Systems: Implications for U.S. Policies," conducts specific research initiatives that facilitate and integrate portions of the regional research project conducted by other participants and represents, updates and coordinates the overall regional research plan. Grant funds also are used to support a research group at the Indiana Experiment Station whose work is closely coordinated with the activities of the Ohio group. The activities of the Indiana group consist of conducting research that contributes to the accomplish-

ment of the regional project objectives and undertakes specific research tasks that complement the regional research plan.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds, appropriated as follows: fiscal year 1989, $300,000; fiscal year 1990, $355,000; fiscal year 1991, $357,000; and fiscal years 1992 and 1993, $368,000 per year. A total of $1,748,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at Purdue and Ohio State Universities.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Research projects have addressed a variety of topics, including the effects of food industry structure on trade liberalization impacts; the consequences of market unification in the European Community for United States agricultural exports; regional competitiveness in the North American egg and tomato markets; and explanations underlying firm behavior patterns important to international trade in food. The U.S. benefits from trade liberalization in processed products. In many countries protection escalates as value added increases and reaches very high rates of protection for food manufacturing industries. Food expenditures patterns by households in the United States and Europe converge as similarities increase in income, demographic characteristics and beliefs about food health relationships. The willingness of United States food companies to engage in exporting food is negatively related to domestic market power. Sales from United States foreign affiliates are nine to ten times larger than exports from United States parent firms. Exports from United States firms to their foreign affiliates are more than twice as large as affiliate exports to the United States. Multinational food corporations export a smaller share of total sales on average than firms with no foreign operations, thus it appears that foreign direct investments and trade are substitute strategies for increasing firm income.

Mr. DURBIN. When do the principal investigators carrying out this work anticipate that the work will be completed?

Dr. JORDAN. These grants support the core group of researchers that facilitate, coordinate, supplement and enhance the research being conducted under the Hatch regional project NC–194. The regional project was approved October 1, 1988 and is currently subject to termination, revision or extension September 30, 1993.

COMPETITIVE GRANTS

Mr. DURBIN. How much of the National Research Initiative funds for fiscal years 1992 and 1993 have been in the field of biotechnology?

Dr. JORDAN. In 1992 and estimated for 1993, $38.2 million of NRI funds have been in the field of biotechnology.

Mr. DURBIN. How much of the NRI funds for fiscal years 1992 and 1993 have been for plant genome mapping?

Dr. JORDAN. In 1992 and 1993, $12.3 million and an estimated $13.0 million, respectively, have been for plant genome mapping.

1890 INSTITUTIONS AND TUSKEGEE UNIVERSITY

Mr. DURBIN. At this point in the record, would you please update the table which appears on page 353 of last year's hearings?

Dr. JORDAN. The requested table will be revised and submitted for the record.

[The information follows:]

INITIATIVE TO SUPPORT 1890 LAND-GRANT INSTITUTIONS AND TUSKEGEE UNIVERSITY

[Program Level—dollars in millions]

Program	1992 actual	1993 current estimate	1994 Budget
Cooperative State Research Service:			
Evans-Allen formula for 1890 institutions	$27.4	$27.4	$28.2
Capacity building grants	10.3	10.3	11.5
Other programs, grants to other historically black institutions	3.8	3.8	2.1
Subtotal, CSRS	41.5	41.5	41.8
Extension Service:			
Formula payments for Extension Service	24.7	24.7	27.8
Facilities grants	9.5	8.0	8.0
Other programs, grants to other historically black institutions	1.9	1.9	2.0
Subtotal, ES	36.1	34.6	37.8
Other agencies:			
Cooperative research, support of agency programs, student assistance and recruiting	11.5	13.3	14.3
Total, program funds	89.1	89.4	93.9

CAPACITY BUILDING GRANTS

Mr. DURBIN. Please list for the record the Capacity Building Grants that were awarded in fiscal year 1992 and those that have been awarded to date for fiscal year 1993.

Dr. JORDAN. A table follows that shows the 1890 Capacity Building Grants awarded in fiscal year 1992. The Peer Review Panel for fiscal year 1993 meets March 22 through 26 to review 164 proposals from the 17 eligible institutions. About one-third are for teaching projects and two-thirds for research. Results should be available from this competition in mid-summer 1993. Also provided is a summary for our fiscal year 1992 program.

[The information follows:]

1890 INSTITUTION CAPACITY BUILDING GRANTS PROGRAM

The objective of this program is to advance the teaching and research capabilities of the 1890 Land-Grant Institutions and Tuskegee University through cooperative initiatives with Federal and non-Federal entities. This program addresses the need to: (1) attract more minority students into the food and agricultural sciences, (2) expand the linkages among the 1890 Institutions and with other colleges and universities, and (3) strengthen the overall capacity of the 1890 Land-Grant Institutions to more firmly establish them as full partners in the food and agricultural science and education system. Teaching projects addressed the following targeted need areas: curricula design and materials development, faculty preparation and enhancement, instruction delivery systems, student experiential learning, instrumentation for teaching, and student recruitment and retention. Research projects addressed high-priority initiatives where there is a present or anticipated need for increased capabilities, such as studies and experimentation in the food and agricultur-

al sciences, the establishment of centralized research support systems, and the development of improved technology delivery systems for producers and consumers. Funds to support research and teaching projects were used as follows:

Research grants	$4,904,820
Teaching grants	4,971,250
	$9,876,070

This program is administered under the authority contained in Section 1472(c) of the National Agricultural Research, Extension, and Teaching Policy Act of 1977, as amended (7 U.S.C. 3318). Eligible institutions include the sixteen 1890 Land-Grant Institutions and Tuskegee University.

1890 Capacity Building Grants Program
1890 Capacity Building Grants - Research

ORGANIZATION	PRINCIPAL INVESTIGATORS	GRANT NUMBER	AMOUNT	AGREEMENT PERIOD
Alabama A&M University Normal, AL 35762 Title: Lipases as Biocatalysts for the Synthesis of Flavor and Fragrance Esters	C. Akoh J. Thompson	92-38814-7475	$ 179,462	08/01/92- 07/31/94
Alabama A&M University Normal, AL 35762 Title: Improved Management of Watersheds Using Remote Sensing and GIS Techniques	T. Coleman O. Montgomery	92-38814-7473	$ 224,959	08/01/92- 07/31/94
Alabama A&M University Normal, AL 35762 Title: Clonal Propagation and In Vitro Culture of Select Improved Pinus Geotypes	G. Brown G. Sharma	92-38814-7474	$ 139,763	09/01/92- 08/31/95
Alabama A&M University Normal, AL 35762 Title: Seed Storage Protein Gene Transformation and Plant Regeneration in Avena and Triticum	G. Sharma	92-38814-7472	$ 227,613	09/01/92- 08/31/95
Tuskegee University Tuskegee, AL 36088 Title: The Effects of Social Support Agents on Young Adult Black Males in Alabama	R. Zabawa N. Baharanyi	92-38814-7478	$ 222,071	09/01/92- 08/31/95
Tuskegee University Tuskegee, AL 36088 Title: Development of Sweet Potato Growth and Biomass Simulation Model for Varied Environments	C. Bonsi H. Janes W. Hill P. Loretan	92-38814-7476	$ 223,509	09/01/92- 08/31/95
Tuskegee University Tuskegee, AL 36088 Title: Gene Transfer to Sweet Potato for Disease Resistance	C. Prakash C. Bonsi	92-38814-7477	$ 140,041	07/01/92- 06/30/95

1890 Capacity Building Grants Program
1890 Capacity Building Grants - Research

ORGANIZATION	PRINCIPAL INVESTIGATORS	GRANT NUMBER	AMOUNT	AGREEMENT PERIOD
Delaware State College Dover, DE 19901 Title: Developing Strategies for Managing Pest and Stress in Urban Forests	N. Dill R. Peiffer P. Sandridge	92-38814-7479	$ 240,694	07/01/92- 06/30/95
Florida A&M University Tallahassee, FL 32307 Title: Wetland Status and Water Quality of North Florida	Y. Hsieh	92-38814-7481	$ 308,124	08/01/92- 07/31/95
Florida A&M University Tallahassee, FL 32307 Title: Compositional and Quality Characteristics of Chevon	V. Lamikanra	92-38814-7480	$ 276,808	07/01/92- 06/30/95
Fort Valley State College Fort Valley, GA 31030-3298 Title: Control of Breeding in Dairy Goats Using Changes in Light and Hormones	E. Amoah S. Gelaye S. Mobini	92-38814-7482	$ 177,565	09/01/92- 08/31/95
Fort Valley State College Fort Valley, GA 31030-3298 Title: Initial Steps Towards "Gene Transfer Farming" in Goats	E. Amoah S. Gelaye S. Mobini	92-38814-7483	$ 223,800	09/01/92- 08/31/95
Kentucky State University Frankfort, KY 40601 Title: Characterization of the Geographic, Morphological, and Molecular Variation in Asimina triloba	M. Callaway	92-38814-7485	$ 113,433	09/01/92- 08/31/95
Kentucky State University Frankfort, KY 40601 Title: All Female Production of Paddlefish	S. Mims	92-38814-7484	$ 214,567	09/01/92- 08/31/95

1890 Capacity Building Grants Program
1890 Capacity Building Grants - Research

ORGANIZATION	PRINCIPAL INVESTIGATORS	GRANT NUMBER	AMOUNT	AGREEMENT PERIOD
Alcorn State University Lorman, MS 39096	P. Igbokwe D. Alipoe H. Rizvi	92-38814-7486	$ 287,456	07/01/92- 06/30/95
Title: Sustainable Vegetable Production in Mississippi				
Langston University Langston, OK 73050	T. Sahlu S. Hart S. Coleman P. Klein	92-38814-7488	$ 345,441	09/01/92- 08/31/95
Title: Determination of Energy Requirements Unique to the Goat				
Langston University Langston, OK 73050	T. Sahlu S. Hart S. Coleman	92-38814-7487	$ 292,925	09/01/92- 08/31/95
Title: Exogenous Hormone and Nutritional Manipulation to Increase Fiber Production				
South Carolina State College Orangeburg, SC 29117	K. Mathur B. Frishberg C. Underwood	92-38814-7489	$ 314,928	09/01/92- 08/31/94
Title: Cholesterol, Selected Mineral and Health Status of the Elderly in South Carolina				
Tennessee State University Nashville, TN 37209-1516	R. Sauve	92-38814-7490	$ 314,857	09/01/92- 08/31/95
Title: Development of Anthracnose Resistant Flowering Dogwood Cultivars				
Prairie View A&M University Prairie View, TX 77446	C. Braithwaite	92-38814-7491	$ 178,253	09/01/92- 08/31/95
Title: Capacity Building in the Development of Molecular Markers for Goat Disease				
Prairie View A&M University Prairie View, TX 77446	G. Osuji R. Cuero	92-38814-7492	$ 185,743	09/01/92- 08/31/95
Title: Development of Bioremediation for Heavy Metal Ion Sequestration by Crops				

1890 Capacity Building Grants Program
1890 Capacity Building Grants - Research

ORGANIZATION	PRINCIPAL INVESTIGATORS	GRANT NUMBER	AMOUNT	AGREEMENT PERIOD
Virginia State University Petersburg, VA 23803 Title: Breed Improvement and Feeding Strategies for Increased Meat Goat Production in Virginia	M. Ezekwe	92-38814-7493	$ 72,808	09/01/92- 08/31/95

Total : $ 4,904,820

1890 Capacity Building Grants Program
1890 Capacity Building Grants - Teaching

ORGANIZATION	PRINCIPAL INVESTIGATORS	GRANT NUMBER	AMOUNT	AGREEMENT PERIOD
Alabama A&M University Normal, AL 35762	G. Wheelock W. Cheatham J. Richardson	92-38820-7494	$ 215,810	08/01/92- 07/31/94
Title: Networked Instructional System for Food and Agricultural Sciences				
Tuskegee University Tuskegee, AL 36088	W. Hill	92-38820-7495	$ 202,500	08/01/92- 07/31/95
Title: Improving Capacity for AG*SAT Related Telecommunications and Distant Learning				
Tuskegee University Tuskegee, AL 36088	E. Jenkins P. Reddy S. Wilson	92-38820-7496	$ 199,486	07/01/92- 06/30/95
Title: Strengthen the Graduate Program in Food Animal Health at Tuskegee University				
University of Arkansas Pine Bluff, AR 71601	J. McCray J. Burleigh	92-38822-7447	$ 199,037	09/01/92- 08/31/95
Title: Bachelor's Degree in Regulatory Science				
University of Arkansas Pine Bluff, AR 71601	E. Neal	92-38820-7497	$ 202,485	09/01/92- 08/31/95
Title: Strategies to Increase Minority Representation in Nutrition and Dietetics				
Florida A&M University Tallahassee, FL 32307	C. Kidd	92-38820-7498	$ 199,594	08/01/92- 07/31/95
Title: Conduct Feasibility Study and Develop an Agricultural Engineering Degree Program				
Florida A&M University Tallahassee, FL 32307	O. Onokpise	92-38820-7499	$ 203,081	08/01/92- 07/31/95
Title: Developing Human Capital in Agronomy and Related Sciences				

1890 Capacity Building Grants Program
1890 Capacity Building Grants - Teaching

ORGANIZATION	PRINCIPAL INVESTIGATORS	GRANT NUMBER	AMOUNT	AGREEMENT PERIOD
Fort Valley State College Fort Valley, GA 31030-3298 Title: Science Apprenticeship Program for High School Juniors and Seniors	C. Magee C. Nguyen N. Brown	92-38820-7500	$ 164,135	09/01/92- 08/31/95
Southern University Baton Rouge, LA 70813 Title: Enhancement of the Southern University Urban Forestry Program	K. Chin B. Phills V. Bachireddy	92-38822-7448	$ 202,500	09/01/92- 08/31/95
University of Maryland - Eastern Shore Princess Anne, MD 21853 Title: Curriculum Development: Masters' of Science Programs in the School of Agricultural Sciences	G. Shorter A. Shaw	92-38820-7502	$ 110,561	09/01/92- 08/31/94
University of Maryland - Eastern Shore Princess Anne, MD 21853 Title: Strengthening Educational Capacities in the Food and Agricultural Sciences	M. Neufville J. Graham	92-38822-7449	$ 172,330	09/01/92- 08/31/94
University of Maryland - Eastern Shore Princess Anne, MD 21853 Title: Enhancing the Dietetics Program at the University of Maryland Eastern Shore	B. Blakely R. Walker	92-38820-7501	$ 169,548	09/01/92- 08/31/95
Lincoln University Jefferson City, MO 65101 Title: Natural Resources Course Development and Enrichment	R. Savage N. Mikkelson	92-38820-7505	$ 106,831	09/01/92- 08/31/95
Lincoln University Jefferson City, MO 65101 Title: Development of GIS Capabilities in Undergraduate Education	F. Hassien R. Savage	92-38822-7451	$ 202,500	09/01/92- 08/31/95

1890 Capacity Building Grants Program
1890 Capacity Building Grants - Teaching

ORGANIZATION	PRINCIPAL INVESTIGATORS	GRANT NUMBER	AMOUNT	AGREEMENT PERIOD
Lincoln University Jefferson City, MO 65101 Title: Student Education, Enhancement and Development	D. Wallace	92-38820-7506	$ 188,532	09/01/92- 08/31/95
Lincoln University Jefferson City, MO 65101 Title: Office of Professional Development	D. Wallace	92-38822-7452	$ 100,000	09/01/92- 08/31/94
Alcorn State University Lorman, MS 39096 Title: Expanding Student Experiential Learning in Agribusiness and International Agriculture	D. Alipoe L. Huam S. Donald	92-38820-7504	$ 202,500	09/01/92- 08/31/95
Alcorn State University Lorman, MS 39096 Title: Curriculum Development in Dairy Sciences	E. Cuadra G. Bates	92-38822-7450	$ 172,330	09/01/92- 08/31/95
Alcorn State University Lorman, MS 39096 Title: Strategic Recruitment of Minorities/K-12 Students for Agriculture Related Careers	K. Simmons	92-38820-7503	$ 199,507	09/01/92- 08/31/95
North Carolina A&T State University Greensboro, NC 27411 Title: Increasing Capacity to Recruit, Retain, and Train Minority and Female High School Students for the Food-Agri.-Environ. Sciences	A. Shahbazi	92-38822-7453	$ 198,000	07/01/92- 06/30/95
North Carolina A&T State University Greensboro, NC 27411 Title: Enhancement of the Graduate Program and Recruitment of Minority Graduate Students in Plant and Soil Science	G. Reddy	92-38820-7508	$ 201,778	07/01/92- 06/30/95

1890 Capacity Building Grants Program
1890 Capacity Building Grants - Teaching

ORGANIZATION	PRINCIPAL INVESTIGATORS	GRANT NUMBER	AMOUNT	AGREEMENT PERIOD
North Carolina A&T State University Greensboro, NC 27411 Title: Improving Capacity for AG*SAT Related Telecommunications and Distance Learning	B. Webb	92-38820-7507	$ 202,500	07/01/92- 06/30/95
Langston University Langston, OK 73050 Title: Recruitment and Retention of Ethnic Minorities in Nutrition and Dietetics Program	D. Gaffney S. Sangiah O. Moten	92-38820-7509	$ 202,401	08/01/92- 07/31/95
Langston University Langston, OK 73050 Title: Minorities in Agriscience Program in Total Quality Management Environment	P. Carey E. Weeks	92-38820-7510	$ 146,840	07/01/92- 06/30/95
South Carolina State College Orangeburg, SC 29117 Title: Building Capacity for Long Range Human Capital Development in Agribusiness	E. Onunkwo M. Kinard	92-38822-7454	$ 202,229	09/01/92- 08/31/95
Prairie View A&M University Prairie View, TX 77446 Title: The TEEN NETWORK	E. Noel A. Parks	92-38820-7511	$ 202,500	09/01/92- 08/31/95
Virginia State University Petersburg, VA 23803 Title: Enhancing Minority Participation in the Food and Agricultural Sciences Using Tele-Communications	A. Allen	92-38822-7512	$ 201,735	09/01/92- 08/31/94

Total : $ 4,971,250

CAPACITY BUILDING GRANTS

Mr. DURBIN. Have any schools experienced problems during the past 12 months with the matching requirement?

Dr. JORDAN. The schools have been extraordinarily successful in meeting the matching requirement. In fiscal year 1992, the schools requested a total of $49.9 million. The institutions received $9.8 million altogether in 49 awards with 79 percent matching support. Proposals for fiscal year 1993 are still in the review stage; so we have not yet had an opportunity to analyze matching support.

MORRILL-NELSON FUNDS

Mr. DURBIN. Please list for the record the distribution of Morrill-Nelson funds compared to the same amount under Smith-Lever. This is the chart that appears on page 367 of last year's hearings.

Dr. JORDAN. The following table shows a comparison of the distribution of the $2.85 million for Morrill-Nelson as opposed to using the Smith-Lever formula as a basis for the distribution.

[The information follows:]

State	Distribution of Morrill-Nelson funds	Distribution using Smith-Lever formula
Alabama	$50,000	$54,577
Alaska	50,000	13,042
American Samoa	50,000	10,251
Arizona	50,000	20,403
Arkansas	50,000	49,579
California	50,000	81,938
Colorado	50,000	31,270
Connecticut	50,000	23,122
Delaware	50,000	14,880
District of Columbia	50,000	0
Florida	50,000	55,390
Georgia	50,000	74,585
Guam	50,000	10,918
Hawaii	50,000	12,768
Idaho	50,000	30,580
Illinois	50,000	101,087
Indiana	50,000	96,980
Iowa	50,000	104,353
Kansas	50,000	56,484
Kentucky	50,000	87,902
Louisiana	50,000	44,614
Maine	50,000	24,302
Maryland	50,000	33,989
Massachusetts	50,000	28,144
Michigan	50,000	91,736
Micronesia	50,000	11,830
Minnesota	50,000	93,645
Mississippi	50,000	49,849
Missouri	50,000	92,120
Montana	50,000	27,654
Nebraska	50,000	53,480
Nevada	50,000	13,287
New Hampshire	50,000	20,511
New Jersey	50,000	27,702
New Mexico	50,000	20,774
New York	50,000	82,718
North Carolina	50,000	103,421
North Dakota	50,000	35,032

State	Distribution of Morrill-Nelson funds	Distribution using Smith-Lever formula
Northern Marianas	50,000	10,143
Ohio	50,000	111,073
Oklahoma	50,000	52,526
Oregon	50,000	39,444
Pennsylvania	50,000	104,575
Puerto Rico	50,000	35,557
Rhode Island	50,000	12,423
South Carolina	50,000	47,629
South Dakota	50,000	37,629
Tennessee	50,000	76,887
Texas	50,000	120,028
Utah	50,000	17,211
Vermont	50,000	19,901
Virgin Islands	50,000	10,816
Virginia	50,000	64,570
Washington	50,000	45,529
West Virginia	50,000	35,243
Wisconsin	50,000	93,614
Wyoming	50,000	16,285
Other (Federal Admin.)	0	114,000
Total	2,850,000	2,850,000

ANIMAL HEALTH AND DISEASE RESEARCH

Mr. Durbin. Please describe how the $5,551,000 appropriated for fiscal years 1991, 1992, and 1993 is being used for the animal health and disease program.

Dr. Jordan. Animal health and disease research funds were allocated by CSRS on a formula basis to accredited schools and colleges of veterinary medicine and State Agricultural Experiment Stations to conduct research that solves a number of problems related to the general welfare, health and productivity of domestic livestock, poultry, aquatic animals and other income producing animals. Both basic and applied research is funded on infectious and non-infectious disease agents which impair the normal state of vital functions. All projects are subject to merit reviews to determine whether or not the proposed research addresses priority research issues developed by CSRS in consultation with constituent groups, including commodity groups. Under the animal health and disease research program, eligible institutions must provide non-Federal matching funds in States receiving annual amounts in excess of $100,000 under this authorization.

Mr. Durbin. Please provide for the record a comparison of how the $5,551,000 will be distributed in fiscal year 1993 and how the same amount would be distributed under the Hatch Act formula.

Dr. Jordan. I will provide a comparison for the record.

[The information follows:]

Comparison of Fiscal Year 1993 Distribution of $5.551.000
Based on Animal Health and Disease Formula versus Hatch Act Formula
(In Dollars)

State/Recipient	Distribution Based on Animal Health and Disease Formula	Estimated Distribution Based on Hatch Act Formula
ALABAMA		
Agricultural Experiment Station, Auburn University	$45.786	$103.899
School of Veterinary Medicine, Auburn University	68.300	0
School of Veterinary Medicine, Tuskegee University	1.968	0
ALASKA		
Agricultural Experiment Station, University of Alaska	6.778	31.459
AMERICAN SAMOA		
Agricultural Exp. Station, American Samoa Community College ...	0	26.599
ARIZONA		
Agricultural Experiment Station, University of Arizona	48.900	44.300
ARKANSAS		
Agricultural Experiment Station, University of Arkansas	83.394	95.180
CALIFORNIA		
Agricultural Experiment Station, Univ. of California, Oakland .	192.383	151.616
School of Veterinary Medicine, University of California, Davis.	262.861	0
COLORADO		
Agricultural Experiment Station and College of Veterinary Medicine, Colorado State University	304.402	63.251
CONNECTICUT		
Agricultural Experiment Station, Univ. of Connecticut, Storrs .	17.969	24.522
Connecticut Agricultural Experiment Station, New Haven	0	24.522
DELAWARE		
Agricultural Experiment Station, University of Delaware	21.057	34.661
DISTRICT OF COLUMBIA		
Agricultural Experiment Station, Univ. of District of Columbia	0	25.758
FLORIDA		
Agricultural Experiment Station, University of Florida	51.269	105.313
College of Veterinary Medicine, University of Florida	80.901	0
GEORGIA		
Agricultural Experiment Station, University of Georgia	19.337	138.788
College of Veterinary Medicine, University of Georgia	122.294	0
GUAM		
Agricultural Experiment Station, University of Guam	0	27.759
HAWAII		
Agricultural Experiment Station, University of Hawaii	7.466	30.985
IDAHO		
Agricultural Experiment Station, University of Idaho	48.693	62.052
ILLINOIS		
Agricultural Experiment Station and College of Veterinary Medicine, University of Illinois	149.716	185.009
INDIANA		
Agricultural Experiment Station and College of Veterinary Medicine, Purdue University	84.060	177.847
IOWA		
Agriculture & Home Economics Experiment Sta., Iowa State Univ.	42.365	190.709
College of Veterinary Medicine, Iowa State University	206.472	0
KANSAS		
Agricultural Experiment Station and College of Veterinary Medicine, Kansas State University	191.687	107.226

State/Recipient	Distribution Based on Animal Health and Disease Formula	Estimated Distribution Based on Hatch Act Formula
KENTUCKY		
Agricultural Experiment Station, University of Kentucky	$79,247	$162,020
LOUISIANA		
Agricultural Experiment Station, Louisiana State University ...	58,254	86,521
College of Veterinary Medicine, Louisiana State University	42,662	0
MAINE		
Agricultural Experiment Station, University of Maine	20,783	51,095
MARYLAND		
Agricultural Experiment Station, University of Maryland	37,758	67,991
MASSACHUSETTS		
Agricultural Experiment Station, University of Massachusetts ..	11,112	57,797
School of Veterinary Medicine, Tufts University	17,927	0
MICHIGAN		
Agricultural Experiment Station and College of Veterinary Medicine, Michigan State University	74,654	168,705
MICRONESIA		
Agricultural Experiment Station, College of Micronesia	0	29,350
MINNESOTA		
Agricultural Experiment Station, University of Minnesota	75,155	172,036
College of Veterinary Medicine, University of Minnesota	99,770	0
MISSISSIPPI		
Agricultural and Forestry Experiment Station and College of Veterinary Medicine, Mississippi State University	71,031	95,651
MISSOURI		
Agricultural Experiment Station, University of Missouri	66,236	169,375
College of Veterinary Medicine, University of Missouri	96,193	0
MONTANA		
Agricultural Experiment Station, Montana State University	71,143	56,940
NEBRASKA		
Agricultural Experiment Station, University of Nebraska	203,572	101,986
NEVADA		
Agricultural Experiment Station, University of Nevada	23,720	31,883
NEW HAMPSHIRE		
Agricultural Experiment Station, University of New Hampshire ..	8,588	44,486
NEW JERSEY		
Agricultural Experiment Station, Rutgers University	18,811	57,030
NEW MEXICO		
Agricultural Experiment Station, New Mexico State University ..	39,460	44,947
NEW YORK		
Agricultural Experiment Station, Cornell University	48,102	137,686
College of Veterinary Medicine, Cornell University	187,249	0
Agricultural Experiment Station, Geneva	0	15,299
NORTH CAROLINA		
Agricultural Experiment Station, North Carolina State University	88,748	189,088
College of Veterinary Medicine, North Carolina State University	12,473	0
NORTH DAKOTA		
Agricultural Experiment Station, North Dakota State University	52,148	69,815
NORTHERN MARIANA ISLANDS		
Agricultural Experiment Station, Northern Marianas College	0	26,408
OHIO		
Ohio Agricultural Research and Dev. Center, Ohio State Univ. ..	72,082	202,433
College of Veterinary Medicine, Ohio State University	38,844	0
OKLAHOMA		
Agricultural Experiment Station and College of Veterinary Medicine, Oklahoma State University	142,627	100,325

State/Recipient	Distribution Based on Animal Health and Disease Formula	Estimated Distribution Based on Hatch Act Formula
OREGON		
Agricultural Experiment Station, Oregon State University	80,325	77,510
College of Veterinary Medicine, Oregon State University	15,690	0
PENNSYLVANIA		
Agricultural Experiment Station, Pennsylvania State Univ.	62,029	191,104
College of Veterinary Medicine, University of Pennsylvania	78,107	0
PUERTO RICO		
Agricultural Experiment Station, University of Puerto Rico	12,870	70,731
RHODE ISLAND		
Agricultural Experiment Station, University of Rhode Island ...	6,275	30,383
SOUTH CAROLINA		
Agricultural Experiment Station, Clemson University	26,051	91,790
SOUTH DAKOTA		
Agricultural Experiment Station, South Dakota State University	99,581	74,345
TENNESSEE		
Agricultural Experiment Station and College of Veterinary Medicine, University of Tennessee	64,278	142,812
TEXAS		
Agricultural Experiment Station and College of Veterinary Medicine, Texas A&M University	410,628	218,052
UTAH		
Agricultural Experiment Station, Utah State University	56,858	38,737
VERMONT		
Agricultural Experiment Station, University of Vermont	13,282	43,427
VIRGIN ISLANDS		
Agricultural Experiment Station, College of Virgin Islands	0	27,580
VIRGINIA		
Agricultural Experiment Station and College of Veterinary Medicine, Virginia Polytechnic Institute and State Univ.	84,628	121,329
WASHINGTON		
Agricultural Experiment Station, Washington State Univ.	28,219	88,125
College of Veterinary Medicine, Washington State Univ.	146,265	0
WEST VIRGINIA		
Agricultural & Forestry Experiment Station, West Virginia ..... State University	11,950	70,184
WISCONSIN		
Agricultural Experiment Station and College of Veterinary Medicine, University of Wisconsin	178,784	171,983
WYOMING		
Agricultural Experiment Station, University of Wyoming	38,629	37,119
Subtotal	5,230,856	5,285,533
Federal administration	222,040	166,530
Small Business Act	79,934	80,767
Biotechnology Risk Assessment	18,170	18,170
Total	5,551,000	5,551,000

Note: Those States which received funding for the Agricultural Experiment Station and the College/School of Veterinary Medicine under the Animal Health and Disease formula distribution will only receive funding for the Agricultural Experiment Station under the Hatch Act formula distribution.

CRITICAL AGRICULTURAL MATERIALS

Mr. DURBIN. For fiscal years 1992 and 1993, please describe how the critical agricultural materials funds are being used.

Dr. JORDAN. The Commercializing Alternative Crops grant to the Polymer Institute at the University of Southern Mississippi have been dedicated to a three phase program of investigation. The first involves lesquerella, a hydroxy fatty acid oilseed crop of similar chemical structure to castor, which is being studied for industrially attractive products such as coatings, waxes, lubricants, greases and cosmetics. Second, the Polymer Institute plans to conduct research for industrial products from the nonwood fibers of kenaf, an annual hibiscus. Third, the product research and development work will be brought to the attention of new businesses ultimately resulting in increased demand for farm production of kenaf.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The Commercializing Alternative Crops program has had $400,000 appropriated in fiscal years 1992 and 1993, totalling $800,000.

Mr. DURBIN. Does this project receive any other Federal funds? If so, please explain the source and amounts.

Dr. JORDAN. The Polymer Institute at the University of Southern Mississippi has received funds from the Department of Agriculture for development of coproducts from guayule, a perennial, natural rubber producing shrub native to the Southwest. In each of fiscal years 1992 and 1993, $85,000 was allocated to the Polymer Institute through actions of the Guayule Administrative Management Committee—GAMC. The GAMC apportioned funds appropriated under the Supplemental and Alternative Crops authority to two major component programs: breeding/genetics and coproducts development.

Mr. DURBIN. What has been accomplished to date with this funding?

Dr. JORDAN. To date, the program has been focused entirely on development of direct uses of lesquerella oil for the coatings industry. Novel polyesters were synthesized which showed excellent wetting, formed hard and smooth films, but required a relatively long drying time. Polymer modifications are underway to achieve desirable properties such as gloss, adhesion, toughness, chemical resistance, water resistance and rapid drying.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the need for Federal funding will be completed?

Dr. JORDAN. The Polymer Institute expects this work to continue for several years. With an appropriation first made in 1992, work has begun only on initial areas of investigation for lesquerella. Keeping with the Administration's policy of awarding research grants competitively, no further Federal funding for this grant is requested.

AQUACULTURE CENTERS

Mr. DURBIN. For fiscal years 1991, 1992, and 1993, $4,000,000 was provided for the Aquaculture Centers. Please describe for the Com-

mittee how the funds were used in fiscal years 1991, 1992, and 1993 at each of these Centers.

Dr. JORDAN. In fiscal years 1991, 1992, and 1993 grants were made for the operation of five regional aquaculture centers. The centers are administered through Mississippi State University, the University of Washington, the University of Massachusetts, Dartmouth—formerly Southeastern Massachusetts University, the University of Hawaii and the Oceanic Institute in a joint effort, and Michigan State University and Iowa State University, also in a joint effort. Each Center's program is uniquely targeted to industry needs and species of the regions. Projects have built-in technology transfer components; are team coordinated with personnel from research, extension, government and industry; and are designed to directly impact commercial aquaculture development. Selected examples of an accomplishment in each region are: design, fabrication, and successful testing of a water circulator for catfish ponds which has reduced the need for expensive aeration by 50 percent—Southern Region; development and testing of a successful vaccine against IHN virus, a major disease in coldwater aquaculture—Western Region; development and testing of strains of oysters which show improved growth and resistance to the devastating MSX disease—Northeastern Region; development of a digest of aquaculture-related statutes for all 12 states in the region and the five most important policy issues—North Central Region; and obtaining support and sponsorship from several major pharmaceutical companies to acquire FDA approval of potential therapeutants—Tropical and Subtropical Region.

Mr. DURBIN. How do these Centers coordinate their research with other programs around the country and with private industry?

Dr. JORDAN. All five Regional Aquaculture Centers are operational with administrative structures consisting of a Board of Directors, Industry Advisory Council and Technical Committee. Coordination at the National level is carried out through a National Coordinating Council.

The Regional Aquaculture Centers are presently sponsoring more than 60 regional projects in support of the U.S. aquaculture industry. The projects involve established and evolving aquaculture firms, and public and private research and educational facilities in virtually every state. Projects address priorities identified by the U.S. aquaculture industry in close cooperation with the Centers' Industry Advisory Councils. Projects include industry partners working in association with the nation's leading aquaculture scientists and extension education specialists. The regional networking fostered by the Centers allows a comprehensive, focused, team oriented approach to addressing the aquaculture industry's most critical needs. In addition, the Director for the Office of Aquaculture, which administers the Regional Aquaculture Centers program, chairs on behalf of the Secretary of Agriculture the Joint Subcommittee on Aquaculture—JSA, a statutory FCCSET committee. JSA is charged with coordinating and implementing the government's National Aquaculture Development Plan.

RANGELAND RESEARCH

Mr. DURBIN. For fiscal years 1991, 1992, and 1993, $475,000 was appropriated for grants for rangeland research, which are awarded on a competitive basis. What is the major thrust of this research and what has been accomplished?

Dr. JORDAN. Results of completed research have led to continual improvement of the resource base. The discovery of a gene that enhances the drought resistance in four wing saltbrush will lead to engineering this important shrub for introduction into droughty sites. Research into the leafy spurge, a noxious invasive weed, was reported. Control may be achieved by training livestock to selectively forage it. Other research examined the biotic control by defining DNA in various subspecies of this weed and then determining the effectiveness of specific insects to the subspecies. Riparian studies defined the relationships between grazing practices and streambank erosion and rehabilitation management practices for the riparian areas. Grazing management determines the condition of the range. Research into grazing summer and winter range has helped determine best management practices for regions of the range. Risk assessment is a necessary part of the rancher's management matrix. Studies examining the sensitivity of factors involved in profitable operation of livestock enterprises continue. The research into ecosystems continues to determine succession patterns and the management of critical range areas.

Rangeland research requires long-term study of the complex ecosystem called range. It also requires a large cadre of scientists and a multidisciplinary approach. Research conducted through these funds has resulted in increased understanding of the many factors defining the ecology of range and the economic strength of the institutions dependent on the range research.

Mr. DURBIN. During fiscal year 1992, what institutions received these grants, in what amounts, and for what types of work?

Dr. JORDAN. The recipients, amounts, and titles of the grants were as follows: Colorado State University, $69,391, "Nitrogen Availability Effects on Competitive Replacement of Grasses by Shrubs"; Texas A&M University, $79,000, "Organization and Function of the Bunchgrass Growth Form: An Alternative Hypothesis"; Utah State University, $77,000, "Improvement of Water-Use Efficiency via Carbon Isotope Discrimination"; Texas Agricultural Research and Extension Center, $72,000, "Flammability and Plant Chemistry: Manipulation Control of Woody Invaders"; Montana State University, $78,000, "Livestock, Forage, and Grasshopper Interactions: Biotic and Abiotic Components"; and Oregon Graduate Institute, $78,000, "Resource Availability in Mesquite/Grassland Systems in the Jornada Basin."

These projects describe a wide range of researchable issues. Much of the work is to examine the underlying science principles that will lead to the understanding of impacts of management on the efficiency of the range use.

SUPPLEMENTAL AND ALTERNATIVE CROPS

Mr. DURBIN. Would you please describe for the Committee the work being carried out under the Alternative Crops Program for fiscal years 1992 and 1993?

Dr. JORDAN. The Supplemental and Alternative Crops Program at this time encompasses activities in two separate product areas. The High Erucic Acid Development Effort—HEADE—program has provided a focal point for the expansion of new industrial uses of high erucic acid oils from crambe and rapeseed. The HEADE program has components of production research, processing research, process and product development, and commercialization.

The HEADE group is a consortium of nine Land Grant Universities, the Kansas Board of Agriculture, ARS-NCUAR, and several private companies. The CSRS Office of Agricultural Materials coordinates the activities of the consortium. The fiscal year 1992 funding supports research through June, 1993. Preproposals for the fiscal year 1993 funding were requested on November 3, 1992, received on December 11, 1992, reviewed by peers and the HEADE Management Committee, and selected for funding in a meeting of the Management Committee held on January 16, 1993. Requests for final proposals were sent on February 23, 1993, to the successful offerors and are due March 15, 1993. The 1993 fiscal year funding will support research through June 30, 1994.

The second program supported under the Supplemental and Alternative Crops Program is an effort to establish a domestic natural rubber industry using the desert shrub, guayule. The program involves both agricultural research to increase rubber yields, and product development and testing to include testing of guayule tires manufactured by private industry and tested by the military and technology for the production of latex, strippable coatings and natural biocides by university researchers.

The guayule development effort is coordinated by the CSRS Office of Agricultural Materials, with participating universities in Arizona, California, Mississippi, New Mexico, and Texas. The fiscal 1992 funding supports work through June, 1994. The 1993 funding was apportioned by the Management Committee as a part of the program and planning meeting held in November, 1992, and the proposals are being processed as they are received.

Mr. DURBIN. Please list the locations where this work is carried out, including the funding levels for fiscal years 1992 and 1993.

Dr. JORDAN. The locations and funding for fiscal 1992 and the estimates for fiscal 1993 will be provided for the record.

[The information follows:]

COOPERATIVE STATE RESEARCH SERVICE SUPPLEMENTAL AND ALTERNATIVE CROPS

	FY 1992	FY 1993 estimate
Guayule research:		
Arizona State University	19,000	19,000
University of Arizona	123,600	168,650
University of California, Riverside	156,100	150,100
Department of Defense	7,300	9,151
University of Southern Mississippi	85,000	85,000

COOPERATIVE STATE RESEARCH SERVICE SUPPLEMENTAL AND ALTERNATIVE CROPS—Continued

	FY 1992	FY 1993 estimate
New Mexico State University	38,000	38,000
Texas A & M University	210,860	144,300
University of Akron		23,000
Subtotal, Guayule Research	639,860	637,201
Biotech Risk Assessment		1,040
Federal Administration	20,040	20,040
Small Business Innovation Research	8,100	9,719
Total, Guayule Research	668,000	668,000
Crambe/rapeseed research:		
University of Idaho	99,500	94,150
University of Illinois	36,500	30,000
Iowa State University	51,549	53,000
Kansas State University	47,800	15,000
University of Missouri	92,589	53,535
University of Nebraska	25,000	26,140
North Dakota State University	86,000	115,900
University of Georgia		30,000
Eastern Michigan University		30,000
International Lubricants, Inc., Seattle, WA	40,000	30,000
Subtotal, Crambe/Rapeseed	478,938	477,725
Federal Administration	15,000	15,000
Small Business Innovation Research	6,062	7,275
Total, Crambe/Rapeseed	500,000	500,000

GUAYULE

Mr. DURBIN. What is the status of the Department of Defense support for guayule?

Dr. JORDAN. Current Department of Defense support for guayule consists of completing contractual obligations with the Goodyear Tire and Rubber Company for aircraft tires and for implementing in-service fleet evaluations as appropriate for aircraft and truck tires. For the F18 and A4 aircraft tires that pass qualifications testing, the Naval Air Systems Command will commence aircraft carrier simulations at the Patuxent River Naval Air Warfare Center, Patuxent River, Maryland. If the simulations are satisfactory, the aircraft tires will be evaluated through placement in and tracking through regular in-service fleet use. The guayule truck tires were manufactured by Bridgestone/Firestone under contract to the Department of Defense and are scheduled in May 1993 for vehicle endurance and performance testing at the Army Proving Grounds, Yuma, Arizona.

SUSTAINABLE AGRICULTURE RESEARCH AND EDUCATION PROGRAM

Mr. DURBIN. For fiscal years 1991, 1992 and 1993, $6,725,000 was provided for the Sustainable Agriculture Research and Education Program. How were these funds used by location?

Dr. JORDAN. The Sustainable Agriculture Research and Education—SARE—funds were used to support research and education projects authorized by the four SARE Regional Administrative

Councils—Table 1. SARE funds were also used for support of national initiatives in the area of sustainable agriculture mandated by the 1990 Farm Bill and approved by the SARE National Operations Committee. In addition, $1,000,000 of the SARE resources were combined with $1,000,000 from USEPA in 1991 and 1992, and $900,000 in 1993 for the Agriculture in Concert with the Environment—ACE—Program. In 1992 and 1993, 561 and 574 SARE proposals were submitted for funding, respectively—Table 2. Current SARE and ACE resources permitted the Administrative Councils to fund only 77 projects in 1992. Deliberations for 1993 are currently in progress. Details about SARE and ACE specific project locations, participants and results were provided to Congress in the 1992 Annual Report, as mandated in the 1990 Farm Bill. The 1993 Annual Report will be submitted to Congress on April 1. I will provide information on the distribution of funds and proposals received by location for the record.

[The information follows:]

TABLE 1. SARE/ACE FY 1988–1992 FINANCIAL SUMMARY

[Dollars in thosuands]

Budget category	FY88	FY89	FY90	FY91	FY92	Total
SARE/LISA projects	3,142	3,647	3,560	4,242	4,103	18,694
ACE projects				1,960	1,920	3,880
Regional administration	262	253	240	398	312	1,465
Outreach initiatives					613	613
National initiatives	332	362	409	842	494	2,439
USDA overhead	164	188	241	283	283	1,159
Total	3,900	4,450	4,450	7,725	7,725	28,250

TABLE 2. FY 1991–1992 SUSTAINABLE AGRICULTURE RESEARCH AND EDUCATION PROGRAM PROPOSALS RECEIVED AND PROJECTS FUNDED BY REGION

Year	Region				Total
	Northeast	Southern	North Central	Western	
Proposals received:					
Fiscal year:					
1991	55	[1] 55	293	57	460
1992	52	227	[2] 255	27	561
1993	[2] 196	208	[3] 135	35	574
Projects funded:					
Fiscal year:					
1991	29	23	14	15	81
1992	12	10	[2] 46	9	77
1993	[4] NA	12	[4] NA	12	24

[1] Full proposals only Southern and North Central Regions use a preproposal process, while the Northeastern and Western Regions request full proposals

[2] Includes new "Farmer Initiated Grants Program". This initiative will be continued in FY1993 in the North Central Region and implemented in FY1993 for the first time in the Northeast Region.

[3] FY1993 "Farmer Initiated Grants Program" request for proposals will not be issued until June

[4] FY1993 information not available.

REGIONAL COUNCILS

Mr. DURBIN. Please list the four regional councils, their membership, and their annual budgets.

Dr. JORDAN. The members of the four Sustainable Agriculture Research and Education—SARE—Program Administrative Councils are listed in Table 3. The 1993 SARE budget includes the allocations for each region—Table 4. I will provide both of these tables for the record.

[The information follows:]

TABLE 3. SUSTAINABLE AGRICULTURE RESEARCH AND EDUCATION PROGRAM REGIONAL ADMINISTRATIVE COUNCILS.

Northeast Region:	
Anthony Potenza	Farmer (New York).
John Merrill	Farmer (New Hampshire).
William Doepkens	Farmer (Maryland).
Bill Kruesi	Non-Profit Private (VT).
John Haberern	Non-Profit Private (PA).
Robin Haggie	Non-Profit Private (MD).
Patrick Madden	USDA/CSRS (California)
James Bushnell	USDA/ES (D.C.).
Robert Miller	SAES & SCES (RI).
William Lacy	SAES (Pennsylvania).
Gordon Marten	USDA/ARS (Maryland).
Ray Eid	Agribusiness (Delaware).
Mark Safley	USDA/SCS (D.C.).
Harry Wells	USEPA (D.C.).
Brian Mrazik	USGS (New Hampshire).
Karl Valley	State Ag Dept (PA).
Fred Magdoff	SARE Coordinator (Vermont).
Southern Region:	
James Horne	Non-Profit Private (OK).
John Charles Wilson	Farmer (Tennessee).
Tom Trantham	Farmer (South Carolina).
Rick Kocurek	Farmer (Texas).
Walter Rowden	Farmer (Arkansas).
J. Neil Rutger	USDA/ARS (Mississippi).
George W. Bird	USDA/CSRS (D.C.).
Rufus Jones	1890 Extension (Missouri).
Charles Panton	1890 AES (North Carolina).
Jim Bushnell	USDA/ES (D.C.).
Raymond Campbell	1862 CES (Oklahoma).
Gerald Jubb	1862 AES (Virginia).
Mark Safley	USDA/SCS (D.C.).
Harry Wells	USEPA (D.C.).
Bob Odum	State Ag Dept (Louisiana).
Noble Usherwood	Agribusiness (Georgia).
Darwin Knochenmus	USGS (Louisiana).
William Brown	SARE Program Coordinator (LA).
North Central Region:	
Ken Taylor, Chairman	Non-Profit Private (MN).
Karl Stauber	Non-Profit Private (MN).
Tom Guthrie	Farmer (Michigan).
Ray Berry	Farmer (South Dakota).
Gary Young	Farmer (Nebraska).
Fred Kirschenmann (Past Chair)	Farmer (North Dakota).
Don Holt	SAES (Illinois).
Eldon Ortman	SAES (Indiana).
Ken Holscher	SCES (Iowa).
Hans Kok	SAES (Kansas).

TABLE 3. SUSTAINABLE AGRICULTURE RESEARCH AND EDUCATION PROGRAM REGIONAL ADMINISTRATIVE COUNCILS.—Continued

Frieda Eivazi	SAES (Missouri).
Bradley Brummond	SCES (North Dakota).
Clive Edwards	SAES (Ohio).
Richard Klemme	SCES (Wisconsin).
Eldean Gerlott	USDA/ARS (Illinois).
Clarence Maesner	USDA/SCS (Washington).
Harry Wells	USEPA (D.C.).
Patrick Madden	USDA/CSRS (California).
Steve Waller	SARE Program Coordinator (NE).
Western Region:	
Harry Wells, Chairman	USEPA (D.C.).
Lee Leachman II	Farmer (Montana).
Robert Reginato	Farmer (California).
Larry Thompson	Farmer (Oregon).
Margaref Clark	Non-Profit Private (WA).
Jim Dyer	Non-Profit Private (CO).
Patrick Madden	USDA/CSRS (California).
Jim Bushnell	USDA/ES (D.C.).
Robert Heil	SAES (Colorado).
Jerry Schickendanz	SCES (New Mexico).
Clarence Maesner	USDA/SCS (Washington).
Janet Hren	USGS (California).
David Schlegel	SARE Program Coordinator (CA).

TABLE 4. FY 1993 SUSTAINABLE AGRICULTURE RESEARCH AND EDUCATION PROGRAM BUDGET

Northeast Region	
SARE Projects and Administration	$1,185,425
ACE Projects	350,000
Total	1,535,425
Southern Region:	
SARE Projects and Administration	1,175,425
ACE Projects	360,000
Total	1,535,425
North Central Region:	
SARE Projects and Administration	1,185,425
ACE Projects	350,000
Total	1,535,425
Western Region:	
SARE Projects and Administration	1,185,425
ACE Projects	350,000
Total	1,535,425
National Initiatives:	
National Agricultural Library	100,000
Economic Assessment Project (ACE)	390,000
Sus. Agric. Network	175,000
Demonstration Projects	140,000
PLANETOR	80,000
Sus. Agric. Quality of Life	70,000
Associate Director Office	140,000
Special Projects	52,300
Total	1,147,300

TABLE 4. FY 1993 SUSTAINABLE AGRICULTURE RESEARCH AND EDUCATION PROGRAM BUDGET—Continued

Administrative Overhead	336,000
Budget Summary:	
SARE Program Budget	5,825,000
ACE Program Budget	1,800,000
Total	7,625,000
Regional Programs	6,141,700
National Initiatives	1,147,300
Administrative Overhead	336,000
Total	$7,625,000

Mr. DURBIN. Please provide for the record the USDA funds related to sustainable agriculture, by agency, for fiscal years 1991, 1992 and 1993.

Dr. JORDAN. I will provide the requested information for the record.

[The information follows:]

UNITED STATES DEPARTMENT OF AGRICULTURE—SUSTAINABLE AGRICULTURE

[Dollars in thousands]

Agency	FY 1991	FY 1992	FY 1993
Agricultural Research Service	$112,520	$120,000	$120,000
Cooperative State Research Service	84,586	90,459	90,559
Extension Service	35,600	37,605	37,605
Economic Research Service	287	215	215
Total, USDA	$232,993	$248,279	$248,379

WEATHER INFORMATION CENTER

Mr. DURBIN. For fiscal years 1992 and 1993, please describe how the funds are being used for the Weather Information Center.

Dr. JORDAN. The University of North Dakota was essentially required to meet the criteria established for a State Agricultural Weather Information System as described in the 1990 Farm Bill under Section 1640 of Public Law 101-624. This requires planning and administering a State weather system that will collect observational weather data and provide it to the National Weather Service, develop methods for packaging information received from the national system for use by agricultural producers, and develop programs to educate agricultural producers on how to best use weather and climate information to improve management decisions. This will be a joint activity between the University of North Dakota and North Dakota State University.

Mr. DURBIN. How long has this Center been in existence, and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The Center came into existence with the funding provided in fiscal year 1992, which was $400,000. In fiscal year 1993 the same amount was appropriated, reaching a total of $800,000.

Mr. DURBIN. Does this Center receive any other Federal funds? If so, please describe the sources and amounts.

Dr. JORDAN. There are no other Federal funds supporting the North Dakota Agricultural Weather Information System.

Mr. DURBIN. What has been accomplished to date by the Center?

Dr. JORDAN. Development of computer software that has been focused on three primary areas. The first is for gathering weather data from automated stations across North Dakota set up and maintained by North Dakota State University. Communications software is being developed to provide cost-effective distribution of weather information to system users. Finally, analysis and display software is being developed to provide users with information through home computers.

HIGHER EDUCATION

Mr. DURBIN. How many doctoral students and masters fellows are being supported with the $3,500,000 provided for fiscal year 1993?

Dr. JORDAN. Eighty-nine proposals have been received for fiscal year 1993 Graduate Fellowships Grants. A peer review panel of outstanding scientists and educators will meet April 14–16 to assess the merits of the proposals. It is anticipated that funds are sufficient to support about 63 new doctoral fellows.

Mr. DURBIN. How are the Challenge Grant funds being used in fiscal years 1992 and 1993?

Dr. JORDAN. In fiscal year 1992, $1,455,000 was available through the Challenge Grants Program to support projects to improve undergraduate programs through: curricula design and materials development; faculty preparation and enhancement for teaching; instruction delivery systems; and student experiential learning. A total of 67 different institutions from 44 States and U.S. Territories submitted 131 proposals for consideration for funding during the third year of the program. In June 1992, the grant applications were evaluated by a 25-member peer review panel. The panel was comprised of university scientists and educators, Federal scientists, and representatives of key national associations representing higher education in the academic areas of business, agriculture, natural resources, forestry, veterinary medicine, home economics, and closely allied disciplines. Based on the peer review deliberations, 25 grants were awarded to 17 institutions in 16 states. I will provide a chart for the record which presents information on grants awarded in fiscal year 1992 under the Higher Education Challenge Grants program. For fiscal year 1993, 110 proposals were submitted for Challenge Grants. A peer review panel is meeting March 9–12 to assess the merits of these proposals. Awards will be determined and announced in late summer 1993.

[The information follows:]

PROJECTS SUPPORTED VIA CHALLENGE GRANTS, FY 1992

PROPOSAL NUMBER	PROJECT DIRECTOR	INSTITUTION	TITLE OF PROJECT	FUNDS AWARDED
9203325	Donald H. Lewis	Texas A&M University	An Inter-Institutional Course on Aquatic Pathobiology for Veterinary Students	$ 68,883
9203223	Michael H. Stitsworth	Purdue University	Developing the International Skills and Capacities of Agriculture Undergraduates	$ 58,661
9203306	Gerald J. Pijanowski	University of Illinois	Production of Lifelike, Full Size, Flexible Teaching Models of Food Animals	$ 63,910
9203251	Sylvia Yuen	University of Hawaii at Manoa	Hawaii International Program in Textiles and Clothing (HIP-TXCL)	$ 63,956
9203294	Hugh O. Canham	SUNY College of Environmental Science and Forestry	Education for Forest Resources: New Directions for the 21st Century	$ 61,629
9203315	James E. Coufal	SUNY College of Environmental Science and Forestry	Integrative Instructional Units in Environmental Ethics	$ 62,054
9203207	Glen H. Smerage	University of Florida	A Microcomputer Classroom Lecture Aid for Undergraduate Food and Agricultural Sciences	$ 56,149
9203236	Donald H. DeHayes	University of Vermont	The Development and Implementation of an Integrated Core Curriculum in Natural Resources	$ 61,300

9203234	Lois A. Lund	Michigan State University	Food Science/Nutrition/Business: New Interactions between University and Industry	$ 64,000
9203216	Jan M. Hathcote	University of Georgia	Entrepreneurial Curriculum for the Restaurant and Apparel Industries	$ 60,454
9203246	Wayne A. Johnson	Ohio State University	Ensuring a Highly Competent Nutrition and Food Science Professional Workforce	$ 63,958
9203302	Marcia L. Cordts	Cornell University	Enhancing Agricultural Education through Microbiology: A Computer Based Tutorial	$ 61,462
9203318	Pascal A. Oltenacu	Cornell University	A Multimedia System for Developing Skills in Dairy Herd Management	$ 64,000
9203224	Don D. Jones	Purdue University	Impact of Agricultural Practices on Water Quality: Computer-Aided Instruction	$ 60,947
9203242	Ronald J. Seibel	University of Maryland	Development of a Cooperative Distant Learning Delivery System for Agriculture	$ 63,952
9203254	Roger M. Swagler	University of Georgia	Introducing Global Development Issues into the Curriculum: A Modular Approach	$ 62,852
9203258	Edgar Chambers	Kansas State University	Sensory Analysis Education for the Food Sciences Curriculum	$ 63,714
9203296	Steve R. Simmons	University of Minnesota	Development of Decision Cases in Farming Systems Management	$ 40,000

9203200	Scott Rundell	Morehead State University	Enhancing Undergraduate Programs: Development of an Educational Model for Environmental Concepts in Agriculture	$ 60,254
9203205	William L. George	University of Illinois	Educating Students to Function in Their Future and to Adapt to Change	$ 64,000
9203298	Barbara M. Reagan	Kansas State University	Cooperative Research Experience in Textiles for College and High School Students	$ 57,419
9203305	John J. Cunningham	University of Massachusetts	The Use of Computer-Mediated Telecommunications as an Instructional Aid	$ 51,386
9203290	Clair J. Nixon	Texas A&M University	Agribusiness Education: Enhancing the Involvement of the College of Business Administration and Graduate School of Business at Texas A&M University	$ 40,000
9203313	John P. Fetrow	University of Minnesota	A Specialized Senior Year Food Animal Program for Veterinary Medical Education	$ 40,000
9203317	Kathryn R. Treat	New Mexico State University	Modeling Leadership Development for a Diverse Workforce in Food and Agriculture	$ 40,000

AG*SAT

Mr. DURBIN. What level of funding is devoted to AG*SAT in fiscal years 1992 and 1993?

Dr. JORDAN. The Challenge Grants program supports four different types of projects to strengthen undergraduate education, one of which is innovative delivery systems. Requests to support AG*SAT projects fall within this category. In the Challenge Grants program money is not targeted for any specific type of project. Therefore, no funds are devoted exclusively to AG*SAT. Rather, we work very closely with our university cooperators to promote innovative types of projects, such as AG*SAT, so that universities can take advantage of opportunities afforded by this program. This approach seems to be working, since in 1993 we have received 8 proposals for AG*SAT-related projects which requested a total of almost $630,000. During fiscal year 1992, a very innovative AG*SAT project at Texas A&M University was awarded $69,000 via the Challenge Grants Program. The project is developing an inter-institutional course on aquatic pathobiology for veterinary students. The course will be offered to the Gulf States Consortium of Veterinary Colleges. Also in fiscal year 1992, the 1890 Capacity Building Grants Program supported two AG*SAT projects at 1890 land-grant institutions. These two projects, located at North Carolina A&T State University and Tuskegee University, were awarded a total of $405,000.

Also, the Extension Service was appropriated $1,221,000 per year in fiscal years 1992 and 1993 for an Agricultural Telecommunications Program.

Mr. DURBIN. What are the plans for fiscal year 1994?

Dr. JORDAN. We continue to dialogue and interact with the AG*SAT organization and the university system to promote innovative course-delivery through telecommunications. We are encouraging AG*SAT-related proposals for competitive grants in both the Challenge Grants Program and the 1890 Capacity Grants Program. We anticipate that such proposals will continue to be successful in securing funding through these two programs.

In its 1994 budget request, the Extension Service is requesting $1,221,000 to continue the Agricultural Telecommunications Program.

FEDERAL RESEARCH RELATED TO AGRICULTURE

Mr. DURBIN. For fiscal years 1991, 1992 and 1993, would you please provide for the record a table which shows how much basic research in agriculture is funded by USDA; and how much is funded by the National Institutes of Health, the National Science Foundation, and other agencies of the Federal Government?

Dr. JORDAN. Every year the National Science Foundation—NSF—conducts a survey entitled "Federal Funds for Research and Development". Research is broken out into a number of fields of science, one of which is agricultural. For several years, CSRS has used the agricultural estimates from this NSF report as the source of the following data for agencies other than USDA. However, the most recent NSF Report was published in July 1992 and has not

yet been updated to reflect 1992 actual data or an estimate of 1993 appropriations.

The USDA data is based on the total amount of USDA's basic research as provided to the Office of Management and Budget.

[The information follows:]

FEDERAL OBLIGATIONS FOR BASIC RESEARCH RELATED TO AGRICULTURE

[Dollars in thousands]

Federal agency	FY 1991	FY 1992	FY 1993
Department of Agriculture	$557,500	$595,100	$596,700
National Institutes of Health	0	0	NA
National Science Foundation	0	0	NA
Other Federal agencies	6,677	6,298	NA
Total	564,177	601,398	596,700

NA = Not Available

SHRIMP AQUACULTURE RESEARCH

Mr. DURBIN. Are there any economic studies that estimate the potential size of the domestic shrimp aquaculture industry?

Dr. JORDAN. The U.S. Marine Shrimp Farming Program estimates that the domestic shrimp farming industry has the potential for significant expansion over the next ten years. In 1992, domestic shrimp farms produced 4.4 million pounds of farmed shrimp valued at $12–$15 million. This represents an increase of 25 percent over 1991 production. As technological advances improve the profitability of domestic shrimp farming, production levels should continue to increase. Additionally, the U.S. is poised to become the world leader in the production and sale of specific pathogen free genetically improved seed and stocks of marine shrimp.

Mr. DURBIN. Please describe the work that is being done on freshwater shrimp.

Dr. JORDAN. The research on freshwater shrimp is aimed at improving production efficiency and profitability through improved management strategies and the utilization of alternative production systems. Stocking rates, supplemental feeding, grading, crawfish-prawn co-production, and harvesting strategies have been evaluated. Additionally, research findings from experimental trials using small ponds are currently being verified in large commercial production systems.

FEDERAL ADMINISTRATION

Mr. DURBIN. Would you please provide for the record an object classification table for Federal administration, including all funds available for that purpose for fiscal years 1991, 1992, and 1993?

Dr. JORDAN. The requested table on Federal Administration funds will be provided for the record.

[The information follows:]

COOPERATIVE STATE RESEARCH SERVICE

CLASSIFICATION BY OBJECTS FOR FEDERAL ADMINISTRATION FUNDS

[Fiscal year 1991 and estimated 1992 and 1993—In thousands of dollars]

		1991	1992	1993
	Personnel Compensation:			
11	Total personnel compensation	$7,813	$9,123	$9,876
12	Personnel benefits	1,323	1,567	1,695
13	Benefits for former personnel	8	6	6
	Total personnel compensation and benefits	9,144	10,696	11,577
	Other Objects:			
21	Travel	1,342	1,540	1,590
22	Transportation of things	29	68	69
23	Communications, utilities and misc. charges	549	813	818
24	Printing and reproduction	224	306	309
25.1	Consulting services	0	203	203
25.2	Other services	2,586	3,160	2,321
26	Supplies and materials	337	289	299
31	Equipment	342	355	405
41	Grants, subsidies, and contributions	17,955	19,192	19,338
	Total, other objects	23,374	25,926	25,352
	Total Direct Obligations	32,508	36,622	36,929

PEER PANELS

Mr. DURBIN. How much did CSRS pay out in honoraria and travel for peer panels in fiscal year 1992? What is the budget for fiscal year 1993?

Dr. JORDAN. CSRS honoraria costs were $202,650 in fiscal year 1992. CSRS travel costs were $387,400 in fiscal year 1992. In fiscal year 1993, estimated costs for honoraria and travel are $203,000 and $400,000, respectively.

Mr. DURBIN. Please provide a table for the record listing honoraria and travel, by program, for fiscal year 1992.

Dr. JORDAN. Non-Federal scientists serving on CSRS peer panels received $150 per day for every day that the panel met, which usually ranged from one to four days depending on the number of proposals submitted under the program. I will provide a table for the record showing how much honoraria and travel were paid under each CSRS program that required peer panels to review competitively awarded grant proposals.

[The information follows:]

CSRS FISCAL YEAR 1992 PEER PANEL HONORARIA AND TRAVEL COSTS

Program	Honoraria	Travel	Total costs
Higher Education Graduate Fellowships Grants	$4,500	$9,787	$14,287
Higher Education Challenge Grants	11,400	13,227	24,627
1890 Institutions Capacity Building Grants	14,250	23,312	37,562
Rangeland and Water Quality Research Grants	20,850	54,072	74,922
Special Research Grants (Aquaculture)	1,500	3,742	5,242
Biotechnology Risk Assessment Grants	1,200	9,000	10,200
National Research Initiative Competitive Grants	137,700	252,229	389,929
Small Business Innovation Research Grants	11,250	22,044	33,294
Total	202,650	387,413	590,063

CENTER FOR AGRICULTURE AND RURAL DEVELOPMENT

Mr. DURBIN. Please provide a description of the work that has been done under this program to date and the period of the existing contract.

Dr. JORDAN. This grant funds a program of university research to support the Office of the United States Trade Representative in the current Uruguay round of negotiations. The research includes providing background information on international trade in agriculture and analyses of the implications of trade policy alternatives on the agricultural sector of the United States and other countries. The results are used by the negotiators. The fiscal year 1992 grant is scheduled to terminate in November 1993. The fiscal year 1993 grant proposal has been received by CSRS and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. This research program was initiated in fiscal year 1989. Grants have been awarded from funds appropriated as follows: fiscal year 1989, $750,000; fiscal years 1990 and 1991, $741,000 per year; and fiscal years 1992 and 1993, $750,000 per year. A total of $3,732,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. The research program is carried out by the Center for Agriculture and Rural Development at Iowa State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. An extensive number of research analyses and studies on policy issues and topics pertaining to the Uruguay round of negotiations have been completed and provided to the negotiators. Studies include the development of international trade models and assessments of trade options for meat, dairy, grains and oilseeds. Analyses include determination of the implications of export subsidies, import protection, tariffication, farm programs, and other price distortion effects on trade. A study was completed on the impacts of the European Community's Common Agricultural Policy reform package and an evaluation of production entitlement guarantee programs. Trade impact studies were completed for six developing countries including Argentina, Brazil, Indonesia, the Philippines, South Korea, and Thailand. Examples of studies in progress include an assessment of trade policies on the broiler industry, economic aspects of decoupling agricultural support, Japanese agricul-

tural reform, and efficiency of farm programs, compensations, and the gains from trade.

Mr. DURBIN. When do the principal researchers carrying out this work anticipate that the work will be completed?

Dr. JORDAN. The university researchers anticipate that the work should be finished upon completion of the Uruguay Round trade negotiations.

HERD MANAGEMENT

Mr. DURBIN. Please provide a description of the work that has been done under the herd management program to date and the period of the existing contract.

Dr. JORDAN. The research plan for the Herd Management Program was initiated in fiscal year 1991. Research is underway to compare two systems that evaluate the effects of pre-washing management on growth performance and carcass quality of genetically developed lean beef and Holstein cattle. The first lean beef experiment was concluded on November 11, 1992. Carcass parameters are being collected from slaughtered cattle to evaluate benefits of genetically lean beef. Results will provide information that will enable beef producers to meet demands of consumers, for low-fat beef. The fiscal year 1992 grant supports research through February 1993. The fiscal year 1993 proposal has been received and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991 and the appropriation for fiscal year 1991 was $375,000. The 1992 and 1993 appropriation is $475,000 per year. A total of $1,325,000 has been appropriated.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. The research is being carried out by scientists at Tennessee State University, Nashville, Tennessee.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Under the Herd Management Program, investigators at Tennessee State University have completed one genetic study in which carcasses from slaughtered cattle are being analyzed for protein, fat, cholesterol and other standard carcass parameters that are of primary interest to the consuming public. Results from this study will provide information that will determine whether or not the beef produced through genetic selection—"Lean Beef"—and standard herd management practices is leaner and more responsive to the demands of the consuming public.

Mr. DURBIN. When do the principal researchers anticipate that this research will be completed?

Dr. JORDAN. The investigators anticipate that this research will be completed in fiscal year 1997.

GULF COAST SHRIMP AQUACULTURE

Mr. DURBIN. Please provide a description of the work that has been done under this program to date and the period of the existing contract.

Dr. JORDAN. Studies have been conducted on growout intensification, prevention and detection of diseases, seed production, and the development of specific pathogen free stocks. Performance trials in various production systems have been conducted. High production levels have been demonstrated in these systems. Maturation and reproductive performance in seed production systems has reached commercial feasibility. Protocols for viral detection have been improved and have led to the development of specific pathogen free stocks of commercial importance.

In fiscal year 1993, emphasis will be placed on development of specific pathogen free and genetically improved broodstock and seed as well as shrimp health technologies. Additionally, research will continue in the areas of culture system technologies, economies, regulations and marketing. The fiscal year 1992 grants to Hawaii and Mississippi extend through January 1993 and December 1993, respectively. The fiscal year 1993 grant proposals have been approved by CSRS.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1985, $1,050,000; fiscal year 1986, $1,236,000; fiscal year 1987, $2,026,000; fiscal year 1988, $2,236,000; fiscal year 1989, $2,736,000; fiscal year 1990, $3,195,000; fiscal year 1991, $3,365,000; and fiscal years 1992 and 1993, $3,500,000 per year. A total of $22,844,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The work is being carried out through grants awarded to the Oceanic Institute, Hawaii and the Gulf Coast Research Laboratory in Mississippi. In addition, research is conducted through subcontracts at the University of Southern Mississippi, Tufts University, the Waddel Mariculture Center in South Carolina, the Texas Agricultural Experiment Station, and the University of Arizona.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Studies have been conducted on growout intensification, prevention and detection of diseases, seed production, and the development of specific pathogen free stocks. Performance trials in various production systems have been conducted. High production levels have been demonstrated in these systems. Maturation and reproductive performance in seed production systems are now commercially feasible. Protocols for viral detection have been improved and have led to the development of specific pathogen free stocks. These specific pathogen free stocks have been evaluated in most of the commercial shrimp farms in the U.S. and have demonstrated consistently superior performance over previous stocks leading to a more profitable industry. The development of these stocks has also established the U.S. as the primary source of specific pathogen free shrimp seed world wide.

Mr. DURBIN. When do the principal researchers anticipate that this research will be completed?

Dr. JORDAN. The researchers anticipate that the specific research outlined in the current proposal will be completed in fiscal year 1994. However, the researchers indicate that funding through fiscal

year 1998 would be necessary to maximize the commercial impact of this research.

VOCATIONAL AQUACULTURE EDUCATION

Mr. DURBIN. Please provide a description of the work that has been done under this program to date and the period of the existing contract.

Dr. JORDAN. In 1990, Congress, through USDA's Office of Higher Education Programs, began funding a multi-year project to: develop curricula and support elements, field test content, and conduct national teacher training on the materials. In 1991, utilizing the new instructional materials, schools in Texas, Iowa, Indiana, South Carolina, Pennsylvania and Washington were selected to field test the curriculum. They completed the field tests January, 1992. Late summer of 1992, teacher teams from all 50 states received training in Raleigh, North Carolina on how to teach the materials. Additionally, a recirculating systems manual was developed and instructors explored the model classroom recirculating system designed and built in cooperation with North Carolina State University. Multiple copies of the 1,100 page, five volume, core curriculum and support materials were sent to all states in the fall of 1992. States are replicating The Council's training program at their own teacher workshop in 1993. The 1992 grant continues through April 30, 1993.

The 1993 grant is being used to: complete and field test specie specific modules, support additional inservice training, design outreach programs to reach multi-cultural audiences, and develop and test units on biotechnology and sustainable agriculture as they relate to aquaculture. Results at test sites include a 50–400% increase in students applying to study aquaculture and the integration of math and science into the curriculum with the full cooperation of teachers in other disciplines.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. A total of $1,747,000 has been appropriated for this program—$247,000 in fiscal year 1990, and $500,000 per year in fiscal years 1991, 1992 and 1993.

Mr. DURBIN. Where is the work being carried out?

Dr. JORDAN. The work is being coordinated by The National Council for Agricultural Education. Its headquarters is in Alexandria, Virginia. The curriculum is being disseminated in all 50 states and U.S. Territories in the Caribbean and the Pacific.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. A new curriculum has been provided and teachers have been trained. As previously noted, enrollments in secondary agricultural education at the curriculum test sites have increased from 50 to 400 percent.

Mr. DURBIN. When do the investigators anticipate the work will be completed?

Dr. JORDAN. The principle investigators have indicated that they may request one additional year of funding to enable them to modify curriculum and complete the dissemination process.

WATER QUALITY—NORTH DAKOTA

Mr. DURBIN. Please provide a description of the work that has been done under the water quality program to date and the period of the existing contract.

Dr. JORDAN. Drilling monitor wells and installation of water monitoring equipment has been completed. Collection of detailed data on the fate and transport of nitrates and pesticides at all field sites is progressing on schedule. Work on biological denitrification and its role in reducing nitrate contamination continues. This research provides training opportunities for undergraduate and graduate students in groundwater geology and agricultural science. The first graduate student participating in this program received his Ph.D. in December, 1992.

The research results are being analyzed and manuscripts prepared for publication. During the coming year considerable research effort will be devoted to preparation of manuscripts and dissemination of information on research results.

Fiscal year 1992 grant funds are supporting research through September 1995. The 1993 proposal has been received and is being processed for award.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. In 1989, $1.0 million was appropriated under the ground water research program. Beginning in 1990, funds have been earmarked under the Direct Federal Administration program. Work supported by this grant was initiated in fiscal year 1990 with an appropriation of $987,000. Subsequent appropriations have been $750,000 in fiscal year 1991, $500,000 in fiscal year 1992 and $500,000 in fiscal year 1993. A total of $3,727,000 has been appropriated for this water quality research program.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of North Dakota through its Energy and Environmental Research Center. A portion of the pesticide research was sub-awarded to North Dakota State University.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. Six field sites have been instrumented to monitor groundwater level in wells, water flow, collection of water samples and measurement of weather variables. Analysis of the water samples showed considerable variation in the nitrate level of the groundwater. Pockets of nitrate enriched water was detected. Intermittent pumping of irrigation wells was found to affect groundwater flow and the vertical displacement of contaminants including nitrate. The results of the study will improve the understanding of the movement and distribution of contaminants under crop production practices in the Northern Great Plains. In addition to the research results, the project provides training opportunities for undergraduate and graduate students in groundwater geology and agricultural science.

Mr. DURBIN. When do the principal researchers anticipate that this research will be completed?

Dr. JORDAN. The current funded project supports research through fiscal year 1995. The research proposal currently submit-

ted for awarding would fund work through fiscal year 1996. The principal researchers have not discussed research plans beyond fiscal year 1996.

WATER QUALITY—ILLINOIS

Mr. DURBIN. Please provide a description of the work that has been done under the water quality program to date and the period of the existing contract.

Dr. JORDAN. The purpose of the research is to provide a scientifically valid basis upon which meaningful agricultural chemical management and regulatory decisions can be based.

The program on Water Quality in Illinois builds upon research initiated in fiscal year 1990. The fiscal year 1992 grant supports research through September 1995. The 1993 grant is being prepared. A research planning meeting is scheduled in March following which the proposal will be submitted.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through FY 1993?

Dr. JORDAN. Research grants have been awarded from funds appropriated as follows: fiscal year 1990, $494,000; fiscal year 1991, $600,000; and fiscal years 1992 and 1993, $750,000 per year. A total of $2,594,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The work is being carried out by the Illinois Groundwater Consortium and coordinated by the Carbondale campus of Southern Illinois University. The research is also being conducted by staff at the University of Illinois, Southern Illinois University, the Illinois State Geological Survey and the Illinois Water Survey at locations across the State.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The Illinois Groundwater Consortium was established to coordinate the research under this project. The research team has accomplished an improved understanding of the fate and movement of herbicides and nutrients under Illinois crop production conditions. New and improved best management practices for crop production in the Midwest have also been developed.

Mr. DURBIN. When do the principal researchers anticipate that this research will be completed?

Dr. JORDAN. The Illinois Groundwater Consortium has an annual planning session which includes all agencies and the principal researchers. The plans for fiscal year 1993 funding will be completed in April 1993 for research to be conducted through fiscal year 1995.

ALTERNATIVE FUELS CHARACTERIZATION LAB

Mr. DURBIN. Please provide a description of the work that has been done under the alternative fuels characterization lab program to date and the period of the existing contract.

Dr. JORDAN. The University submits quarterly reports on this project. The research accomplished last year included examination of the volatile components and degree of volatility of unleaded gasoline and ethanol-gasoline blends. Unleaded gasoline evaporated at a greater rate than ethanol blends in laboratory tests. These results were sent to the U.S. Environmental Protection Agency.

Engine performance and emission variations and environmental changes are continuing to be documented with fuel composition changes. The fuel composition is documented through receiving samples from various active dispensing stations. The 1993 grant supports work through April 1994.

Mr. DURBIN. How long has this work been underway, and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant began in fiscal year 1991, and the appropriations for fiscal years 1991, 1992, and 1993 were $250,000 per year. A total of $750,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of North Dakota.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The research has been in two areas. First, there have been comparisons between the fuel composition at the point of blending and the point of delivery to the vehicle—pump. The second area has been centered on the amount and composition of the volatiles in the blended fuels. This latter research has been reported to the Environmental Protection Agency. The former research has identified the spectrum of blends available in the Nation.

Mr. DURBIN. When do the principal researchers anticipate that this research will be completed?

Dr. JORDAN. A specific termination date has not been established.

MISSISSIPPI VALLEY STATE UNIVERSITY

Mr. DURBIN. Please provide a description of the work that has been done under this program to date and the period of the existing contract.

Dr. JORDAN. Funds administered to Mississippi Valley State University have been used for strengthening and curriculum development. Also, the Southern Association of Colleges and Schools recently approved reaffirmation of accreditation for ten years. The music program has been accredited by the National Association of Schools of Music. The accreditation of these two programs would not have been attainable without this source of financial assistance. The university has reviewed and restructured the core curriculum so as to include instruction pertinent to the development of the students' college level skills and technical knowledge needed for entry into graduate school or chosen professions. The academic programs have been made more relevant to the agrarian population and economy of the Mississippi Delta through curriculum revision and innovation. Efforts have been made to strengthen academic offerings through improvement and expansion of the general honors program to include all disciplines. Emphasis has been given to improving test-taking skills of the students through a systematic efforts beginning in the freshman year and continuing throughout the four-year curriculum. Faculty development has been a major goal. Funds have been allocated for the purchase of materials, supplies and equipment which support a well-prepared faculty.

The fiscal year 1992 grant supports work through September 1992. The fiscal year 1993 grant has been received and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. This program was initiated in fiscal year 1987. Grants have been awarded from funds appropriated as follows: fiscal year 1987, $750,000; fiscal years 1988 and 1989, $625,000 per year; fiscal year 1990, $617,000; fiscal year 1991, $642,000, and fiscal years 1992 and 1993, $668,000 per year. A total of $4,595,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. These funds are intended to strengthen programs at Mississippi Valley State University. The total program has been carried out on the campus at Itta Bena.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The university has recently been approved for reaffirmation of accreditation by the Southern Association of Colleges and Schools and the National Association of Schools of Music has accredited the music program. Steps to reduce costs, reduce student financial aid backlog, improve measures to ensure accountability and the automation of the payroll are other accomplishments which occurred during this period.

Mr. DURBIN. When do the principal researchers anticipate that this research will be completed?

Dr. JORDAN. The objectives of the current grant will be completed by October 1, 1993.

MAIZE GENETICS RESEARCH CENTER

Mr. DURBIN. Please provide a description of the work that has been done under the Maize Genetics Research Center program and the period of the existing contract.

Dr. JORDAN. The goal of this project is to modify the genetic material of maize so that the transposable element Ac is brought into close relationship with a large part of the genome. This will create a publicly available system that can be used to tag and locate important genes. The fiscal year 1992 grant supports research through January 1995. The fiscal year 1993 grant proposal has been received and is being reviewed.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. The work supported by this grant begin in fiscal year 1991 and the appropriation for fiscal year 1991 was $100,000. The 1992 and 1993 appropriation is $400,000 per year. A total of $900,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. Research is being conducted at the University of North Dakota and in winter nurseries in the State of Hawaii.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The Maize Genetics Research Center has undertaken a major assignment to distribute the Ac transposable element on the arms of the ten chromosomes of maize. The purpose of undertaking this project is to make available in the public domain im-

portant genetic stocks that will be used to "genetically tag" maize genes of economic importance.

So far, the first crosses have been made and progeny advanced to second and third generation through winter nurseries in Hawaii and summer plots in North Dakota. The genetic backcrossing sequences are about half completed.

Mr. DURBIN. When do the principal researchers anticipate that this research will be completed?

Dr. JORDAN. We understand that the final genetic stocks will be available for the repository by the end of fiscal year 1995.

GEOGRAPHIC INFORMATION SYSTEM

Mr. DURBIN. Please provide a description of the work that has been done under the geographic information system program to date and the period of the existing contract.

Dr. JORDAN. In fiscal year 1990, a grant entitled "Geographic Information System Technology Transfer Project" was awarded to the American Farmland Trust. Subsequently, the National Center for Resource Innovations was created to carry out the work of providing a structured, organized program for transfer of Geographic Information Systems technology to local governments. Work in fiscal year 1991 built on the base established in fiscal year 1990 at three existing locations, and established two new locations focusing on the transfer of this technology for other purposes—specifically, growth management and weather information.

The fiscal year 1992 grant supports work under this program through May 1993. The proposal for work in 1993 has been received and is being reviewed. It is anticipated that when awarded this grant will support work through May 1994.

Mr. DURBIN. How long has this work been underway and how much has been appropriated through fiscal year 1993?

Dr. JORDAN. Grants have been awarded from funds appropriated as follows: fiscal year 1990, $494,000; fiscal year 1991, $747,000; and fiscal years 1992 and 1993, $1,000,000 per year. A total of $3,241,000 has been appropriated.

Mr. DURBIN. Where is this work being carried out?

Dr. JORDAN. The National Center for Resource Innovation, located in Washington, D.C. coordinates the national program and acts as a liaison between Federal agencies and the State participants. In cooperation with the State Conservationist, the Chesapeake Bay project is carrying out work in Lebanon County, Pennsylvania. Other work is being accomplished in regional centers. The southeastern center is located in Valdosta, Georgia, in affiliation with the South Georgia Regional Development Center. The southwestern center is located in Fayetteville, Arkansas in affiliation with the University of Arkansas. Work began in fiscal year 1991 at the northwest center in Ellensberg, Washington, in affiliation with Central Washington University and at the north central center in Grand Forks, North Dakota, in affiliation with the University of North Dakota. Affiliation of the University of Wisconsin in Madison has been accepted.

Mr. DURBIN. What has been accomplished to date?

Dr. JORDAN. The national office and to a degree the Chesapeake project have concentrated on making national data sets useful to local areas with emphasis on the Chesapeake Bay. The work at the University of Arkansas and the work at Central Washington University have been much like an extension effort with training and other efforts directed at local officials. The Arkansas effort is statewide and focuses on a general use of Geographic Information Systems. The Washington effort is newer and focuses on meeting the State growth planning requirements. Global positioning systems have been acquired by Arkansas in an effort to increase map accuracy for local use. Similar activities have been carried out at the Southeastern site in Georgia which provides more direct service to its ten county area linking with many county government functions. The services provided in Georgia have included enhancement of a regional database with additional satellite imagery emphasizing change for a 10 county area. These data were combined with other low cost imagery such as TIGER files created by the Census Bureau. The North Dakota effort is relatively new. It will facilitate notification of farmers of anticipated storms and other weather events that will impact crops. In addition North Dakota has sought to establish links with the Regional Weather Information Center and to make this information available to geographically dispersed users.

In fiscal year 1992 progress was made in refining the data sets necessary for predicting the potential impact of pesticide application to various soil, crop, rainfall combinations. Training has been carried out for county officials in those regions focusing on the actual transfer. Integration of other data sets relating to land ownership and current use is under discussion at three of the regional sites. Coordination of the program has been slowly improving with the establishment of regional newsletters.

Mr. DURBIN. When do the principal researchers anticipate that this research will be completed?

Dr. JORDAN. This is a pilot project that involves research skills in its implementation. As layers of information are added the framework offers the potential of enhancing a number of research efforts. The project leaders anticipate that this work will be substantially completed in three to four years.

BUILDINGS AND FACILITIES

Mr. DURBIN. Please provide for the record a list of undisbursed funds, by project.

Dr. JORDAN. I will provide a list of undisbursed funds, by project, for the record.

[The information follows:]

Cooperative State Research Service—undisbursed balances as of March 22, 1993 on buildings and facilities grants awarded by CSRS

Building and facility project	*Undisbursed balance*
Alabama: School of Veterinary Medicine, Tuskegee University	$463,135
Arizona: Agriculture Research Complex-Environmental Stress Laboratory University of Arizona	1,158,000
Arkansas:	
Center for Alternative Pest Control Research, University of Arkansas	1,479,070

Building and facility project	*Undisbursed balance*
Poultry Center of Excellence, University of Arkansas	8,889,330
California:	
Grape Importation Facility, University of California, Davis	2,154,483
Alternative Pest Control Containment and Quarantine Facility, University of California, Davis	373,450
Florida: Agricultural Biotechnology Institute, University of Florida	4,043,908
Georgia:	
Biocontainment Facility, University of Georgia	3,291,283
National Laboratory for Environmentally Sound Production Agriculture, University of Georgia	3,266,960
Center for Advanced Water Technology, Savannah State College	364,720
Vidalia Onion Storage Facility, University of Georgia	406,430
Hawaii:	
Center for Applied Aquaculture Research and Training, Makapuu Point Campus, Oceanic Institute, Hawaii	2,863,750
Center for Tropical and Subtropical Agriculture, University of Hawaii	13,530,530
Idaho: Biotechnology Facility, Idaho	1,475,370
Illinois:	
National Soybean Laboratory, University of Illinois	2,001,690
Biotechnology Center, Northwestern University	1,083,490
Indiana:: Molecular and Cellular Biotechnology Facility, Indiana University	6,212,850
Iowa:	
National Center for Food and Industrial Agriculture Products, Iowa State University	3,474,224
Nutrition Research Center, Iowa State University	1,420,448
Kansas: Plant Science Center, Kansas State University	3,626,408
Maine:	
Presque Isle Farm Building Consolidation, University of Maine	898,220
Masardis Research Farm, Maine	152,290
Maryland: Institute for Natural Resources and Environmental Science, University of Maryland	1,806,140
Massachusetts: Center for Hunger, Poverty, and Nutrition Policy, Tufts University	1,014,620
Michigan: Food Toxicology Center, Michigan State University	21,468,060
Mississippi:	
National Center for Development of Natural Products, University of Mississippi (1)	13,440,788
Biological Technology Center for Water and Wetlands Resources, University of Mississippi	180,420
Missouri: Bennett Living and Learning Center, Lincoln University	140,650
Montana: Bioscience Research Laboratory, Montana State University	3,369,780
Nebraska: Center for Advanced Technology, University of Nebraska	7,069,140
Nevada: Biochemistry and Biology Field Research Station, University of Nevada	451,050
New Jersey: Plant Bioscience Facility, Rutgers University	3,194,711
New York:	
New York Botanical Garden	4,895,590
Research Greenhouse, Cornell University	727,500
North Carolina: Bowman-Gray Center for Nutrition, Wake Forest University	3,573,480
North Dakota:	
Industrial Agriculture and Communications Center, North Dakota State University	431,872
Institute for Earth Systems Science, University of North Dakota	107,340
Animal Care Facility, North Dakota State University	242,500
Institute/Agriculture Health Science and Rural Medicine, University of North Dakota	6,721,228
Food Processing Pilot Plant, Northern Crops Institute	727,500
Institute for Agriculture and Rural Health Research Development. Minot State University	2,113,630
Seed Research and Regulatory Facility, North Dakota State	903,070

Building and facility project	*Undisbursed balance*
Ohio: Plant Science Research Facility, University of Toledo	496,640
Oklahoma: National Veterinary Center for Equine and Bovine Biotechnology Research, Oklahoma State University	500,342
Oregon:	
Agricultureal Research Facility. Oregon State University	325,920
Seafood Center, Oregon State University	1,979,770
Pennsylvania: Center for Food Marketing, St. Joseph's University	5,476,620
Rhode Island: Building Consolidation, University of Rhode Island	2,070,501
South Dakota: Northern Plains Biostress Laboratory, South Dakota State University	2,139,746
Tennessee:	
Nursery Crop Research Station, Tennessee State University	1,249,360
Agricultural, Biological and Environmental Research Complex, University of Tennessee, Knoxville	1,670,340
Texas: Institute of Biosciences and Technology, Texas A&M University	584,958
Utah: Biotechnology Laboratory, Utah State University	1,346,970
Vermont: Tree Physiology and Maple Research Laboratory, University of Vermont	337,381
Virginia:	
Agriculture Biotechnology Facility, Virginia Polytechnic Institute and State University	2,782,895
Equine Medical Center Isolation Unit at Leesburg, Va	37
Virginia-Maryland Regional College of Veterinary Medicine	80,497
Washington:	
Center for Information and Technology Transfer, Gonzaga University, Spokane, Washington	2,380,254
College of Veterinary Medicine, Animal Disease Biotechnology Facility, Washington State University	4,838,608
West Virginia: Poultry Research Facility, West Virginia University	3,351,918
Wisconsin:	
Agricultural Biotechnology and Genetics Facility, University of Wisconsin, Madison	12,260,020
College of Natural Resources, University of Wisconsin, Stephens Point	83,420
Wyoming: Environmental Simulation Facility, University of Wyoming	903,070
Total	180,068,375

NOTE:—Includes all Buildings and Facilities funds that are awarded by CSRS even if appropriated to ARS.

Mr. DURBIN. At this point let me yield to my colleague, Mr. Skeen.

Mr. SKEEN. Thank you, Mr. Chairman.

MERIT REVIEW SYSTEM

Dr. Jordan, it is always a pleasure to have you here and have you go through the progress that is being made in the research, and I think that is what has maintained our edge in agriculture and the future where agriculture lies in the work that you are doing.

I want to follow up on the peer review or the merit review system and go into it just a little bit more, if you will. I understand that you have several kinds of organized panels, and some of the reviews go through a centralized merit review program in which each State must submit to you. Would you explain for the committee the concepts that are involved in the peer reviews of agriculture-related projects?

The reason I am asking is that we see a hit list that comes out of various sources when we are talking about cutting back on agriculture research, and a lot of it is, I think, whimsical. But I want to

know that we have got a good merit or peer review system in place. You have expanded on some of it.

Dr. JORDAN. We have a number of aspects to it. Let me first start with the partnership-type funds, the Hatch Act funds, for example. We have two levels there.

One is that on the campus, and we have on our files an approved review process identified for each institution in which they have a mechanism. Even within those dollars which are given to them on a formula basis, for a peer review or a merit review program. When the project arrives in Washington it goes to a scientist in CSRS for counter-signature and checking to be sure that it is consistent with all the rules and regulations.

The second level is for our competitive research grants. When I say that, I mean all of the grants that we give out in a competitive mode. These are brought before panels, and we use panelists and more reviewers in that process than any other agency of the Federal Government, except for the National Science Foundation.

Mr. SKEEN. There are two distinct types of reviews?

Dr. JORDAN. Quite. This latter type has panels that meet as a group, and we hope the membership of the panels cross all the areas being reviewed by that panel. If they do not, and they often do not, then we go to ad hoc reviews. We mail out proposals to about 9,000 different ad hoc reviewers across the country to get their opinions on the scientific value of it.

And then third, both our facilities and our special grant programs have a review program in which we put together a review panel for each one of them or for small groups of them. These may involve some Federal people, and they may involve some State people or private industry people too. By and large, they are heavy on the Federal side and generally smaller in number of people involved, designed specifically to review that program and to see if it is on target.

Mr. SKEEN. Am I correct in assuming that all the CSRS grants are regularly put under a peer review system?

Dr. JORDAN. Yes, sir, they are. We have another level that I haven't reported to you on, and that is that every year we review about 100 programs at institutions of higher learning. We review their entire program.

Mr. SKEEN. The whole spectrum.

Dr. JORDAN. Yes, sir. We take out a review team that is made up of experts across the country and they spend a better part of a week on campus. We do about a hundred of these a year.

Mr. SKEEN. So you do have a flexible process.

Dr. JORDAN. That is correct. Now obviously in some cases, we are not in a position to say it would be invested better in something else in some instances. It is a yes/no kind of an answer. A special grant would be a good example, or a facility is a yes/no answer, but we don't let them go through unless there is a yes answer.

JOJOBA RESEARCH

Mr. SKEEN. Just as an example, one that we see on the hit list that is near and dear to our hearts in New Mexico, and I think in Peoria, Illinois is the jojoba. Is this a duplication of research effort

in the case of the jojoba oil processing between New Mexico and Peoria, Illinois? You have two distinct research projects going on.

Dr. JORDAN. This one that you are speaking of in New Mexico focuses on moving a gene from jojoba to crambe or rapeseed or another crop. That is more productive in terms of the oil so that the characteristics of the jojoba oil are carried into other crops.

Mr. SKEEN. What are they doing in Peoria?

Dr. JORDAN. I would have to ask my colleagues from ARS that are here.

Mr. SKEEN. Is it a direct duplication or is it a different type of research.

Dr. JORDAN. No, sir, they are compatible.

Mr. SKEEN. So they are productive for both.

Dr. JORDAN. Yes. But if you are interested in the details, why——

Mr. SKEEN. Just give it to me in writing, if you would. Because this constantly arises as one of the research projects that is on the hit list, because nobody knows what jojoba is.

Dr. JORDAN. Well, I think they think it has to do with some kind of health something or other, I suppose.

Mr. SKEEN. Or cosmetics.

Dr. JORDAN. Actually, it is basic gene jockeying.

Mr. SKEEN. Genetic engineering.

Dr. JORDAN. Yes, sir. I will provide information on jojoba research for the record.

[The information follows:]

JOJOBA RESEARCH

The research being conducted on jojoba in New Mexico and Illinois is distinctly different yet aimed at improving the economic acceptability of the oil seed for commercial products. The Plant Genetics Engineering Laboratory at New Mexico State University is attempting to genetically transfer the liquid wax ester producing capability from jojoba to rapeseed and soybeans, both higher yielding and broader production base crops which are far better adapted to U.S. climatic conditions. This work has been underway for four years and an equal amount of time may be needed to achieve functional transgenic plants.

Jojoba work in Illinois is conducted by USDA's Agricultural Research Service at the National Center for Agricultural Utilization Research—NCAUR. Although jojoba oil portions are utilized by the cosmetics industry, the overall cost is unacceptable for other products. NCAUR seeks to develop value-added materials from jojoba meal which makes up roughly 50 percent of the seed product. Research projects with jojoba meal include (a) development—patent applied for—of a unique lower molecular weight protein for use in shampoos as a foaming agent to replace other substances the industry finds objectionable, (b) detoxification for nutritious animal feed, (c) value-added uses for the toxins, and (d) cooperative work with the Jojoba Growers and Processors to restructure the jojoba liquid wax molecule to make it better suited for cosmetics.

NORTH AMERICAN FREE TRADE AGREEMENT

Mr. SKEEN. Let me ask you, too, how do these research projects affect the expansion of world trade insofar as the North American Free Trade Agreement? Does this research play an important role in agriculture which has been an extremely important part of our exports in the world competitive position?

Dr. JORDAN. Agricultural products is the one area we have a positive balance of payments and we want to keep that up; don't we?

Mr. SKEEN. We surely do.

Dr. JORDAN. You have in your pack there a summary of the strategic plan of the university-based system, and we hope that that takes into account all the kinds of grants and projects in laying that out. So some of the impact on the North American Free Trade Agreement and so on is going to be under the Hatch Act or the McIntire-Stennis or the competitive grants program.

Mr. SKEEN. But land-grant colleges will play an important part in the agricultural research which is ongoing so far as world trade and global competitiveness?

Dr. JORDAN. Yes, sir, as will ARS, the Forest Service and Economic Research Service.

LAND-GRANT UNIVERSITIES

Mr. SKEEN. Would you agree that our system of research at land-grant universities, cooperatively supported by both state governments and the federal government, has been an important factor in the global competitiveness of the United States?

Dr. JORDAN. Yes. The land-grant university research system is an important source of new knowledge that is making a major contribution to this nation's competitiveness in global markets for food, agriculture, and forest products. The land-grant universities are developing and disseminating to businessmen and policymakers a wealth of knowledge about foreign national product preferences and tastes, developing new commodities and value-added products to satisfy buyers in selected export markets, developing information on the organization of these markets and how to sell in them, conducting analyses of the implications of the various trade negotiations underway, and sending teams to the countries of the former Soviet Union and other countries to learn about and develop markets for U.S. products. These efforts are helping expand markets for U.S. made products and support the economies of rural America.

Mr. SKEEN. Do you feel it is important to maintain the federal role in this research partnership as we level the "playing field" of international trade through initiatives such as the North American Free Trade Agreement?

Dr. JORDAN. Sustaining this federal-state relationship is very important if the United States expects to level the "playing field" and remain competitive in global markets in the future. The trade advantage will reside with those countries who can excel in development of basic and applied research knowledge and be the first to successfully transfer this knowledge to their food, agriculture, and forest product production and processing sectors. The land-grant university system, with federal support, can continue to be a primary source of knowledge and technology transfer activities.

Mr. SKEEN. Do you feel agriculture research at our land-grant universities has a role to play in maintaining environmental quality particularly in our arid states bordering Mexico?

Dr. JORDAN. Yes. A number of our land-grant universities have made substantial investments in hiring faculty and building research facilities for the purpose of enhancing environmental quality. Several of these programs are located in the Southwest. These

programs are and will make substantive research contributions towards alleviating environmental problems found along our southern border.

Mr. SKEEN. Do you feel research and educational facilities for agricultural programs at our land-grant universities are adequate to meet the agricultural and environmental challenge of the next few decades that could threaten our global competitiveness and threaten the quality of our environment?

Dr. JORDAN. The public investment made in agricultural and environmental research resources has been necessary for several reasons. One, fiscal stress among our states is resulting in substantial decreases in funds to just maintain both existing land-grant university faculty staffs and research facilities. Two, the technology for conducting research is changing very rapidly. Three, the research problems are increasingly complex, requiring state-of-the-art facilities and equipment to develop timely and comprehensive results for application. Four, there is a growing demand for multidisciplinary, systems-oriented research that requires new and unique facilities and instruments to accomplish. Five, many developed countries recognize that they must have equivalent or superior research programs to develop the commodities and products to compete against the United States for agricultural markets. Consequently, the United States must continue to make significant investments in agricultural research to maintain a trade advantage in global markets and, to maintain the quality and effectiveness of this research, these investments mut be well-coordinated with other Federal and State efforts and must be competitively awarded. Also, a 1992 National Science Foundation study on university facilities shows that the agricultural sciences have consistently accounted for lower shares of total construction and renovation/repair spending than for other sciences.

Mr. SKEEN. We appreciate the work that has been done and the progress that you have made, and some of it has been rather spectacular. I think that we need to let the people of this country know that the money we spend in agriculture research really goes on the positive side of the ledger.

Thank you very much for your testimony.

Dr. JORDAN. Thank you, sir.

Mr. SKEEN. Thank you, Mr. Chairman.

Mr. PETERSON [presiding]. Thank you.

ARS/CSRS LOCATIONS

May I follow up just a little bit, because I am a little new in this. But I would like to give you an opportunity to give me the distinction between ARS and your facility, and if any are co-located and share resources, and if not, why not?

Dr. JORDAN. The Agricultural Research Service has a very specific and clear mission, and that mission is to support the action agencies of the Department of Agriculture in the execution of their duties and responsibilities.

The Cooperative State Research Service, on the other hand, has the responsibility of bringing into the knowledge base generating system the universities of the United States, and now it has had its

responsibility somewhat broadened beyond the universities in the competitive grants program. What it does is allows access to that enormous resource of talent in the universities of America, so that we can pull out any particular discipline needed at any particular time, without focusing, Mr. Chairman, on tenure or career of an individual. We really focus on issues or a particular talent needed at a particular time and are able to bring it to bear.

It also allows a range of disciplines to be far greater than could ever be rationally supported in the in-house laboratory system without us paying the whole price. But perhaps the key to it is that, on the Federal side, we pay about roughly a quarter of the bill of that university-based system. The rest of it comes from other sources. The giant piece being State appropriations.

So that partnership allows us that range at a very respectable price. The things we do are somewhat related, no question about that, and the Forest Service laboratories, Agricultural Research Service and so on are very often co-located on the same campuses, or contiguous with that campus so that, for all intents and purposes, they are working together.

They have different missions and different end points that they are focusing on, but the science in getting to those end points can be done together. And in fact, they do do it much better. That way the total is substantially greater than the sum of the parts.

TECHNOLOGY TRANSFER

Mr. PETERSON. I knew of the relationship there, and I guess what I am really getting to is, if there is a good system of transfer of data. And if they make a breakthrough on something else that the CSRS is working on, is there a procedure within your organization or USDA to make sure that the data is transferred to other outlying units who are working on perhaps something similar?

Dr. JORDAN. Mr. Chairman, that is a very pungent question, and has several parts to the answer. The first is that at the scientist level. The cooperation, between one scientist to another is one of the areas of terrific interchange, and the fact that they may, in fact, be sharing a graduate student or a technician that might be working in both laboratories or in contiguous laboratories is a big help. Across campus and across institutional lines, the relationship is very close.

Secondly, all of the publicly-supported agricultural research in America, all of it, is contained in the Current Research Information System, a system that is housed on the fifth floor of the National Agriculture Library in Beltsville. ARS doesn't fund any project that isn't hooked to a project number, nor do we. And not only those two agencies, but the Forest Service, Economic Research Service, and all the State funding of agricultural research ends up in there. It contains the name of the principal investigator, the title of the project, and, the institution in which it is found. It also indicates all the other investigators involved, the researchable objectives, the approach. On an annual basis, Mr. Chairman, there is a required summary of accomplishments, including publications. So that is the second level of interaction.

I must tell you that in addition to agriculture research in the CRIS, all the human nutrition research funded by the National Institutes of Health ends up here as well. So it is all in one place.

The third element is that when we go to the strategic planning and being sure what is going on and what ought to be going on, ARS and CSRS and the university system have a crosswalk system that is demonstrable in these kinds of charts. We attend each other's planning sessions and work with one another.

The quadrennial update of the strategic plan for the state university system occurs this year. And there will be representatives present from Extension Service, Agricultural Research Service, Economic Research Service, and Forest Service. They will all be a part of that effort. And the same thing occurs when they develop their plans.

What often happens is that as we sit down to talk to commodity groups, we go together and report at the same time, listen to each other and communicate about what we should be reporting and what we should be doing before we get there.

AWARDS PROGRAM

Mr. PETERSON. Okay. I am encouraged by that. One of my problems is, and there is so much research we do in this country, is that we don't share that information, and in fact, we award those who hide their information in the process. Do you have an awards program that you have developed for your researchers that would award and really substantiate the good works of cooperation as opposed to encouraging pocketing data, so that that one individual gets that award, or gets that prestige or whatever in the process of this? Or do we do this in a very, very cooperative way and give an award program that takes into consideration how much those people are disseminating their data?

Dr. JORDAN. There are several parts to that answer, too, but the main one Mr. Chairman, would be that the Department of Agriculture has an annual awards program, and in that it has allocated annually about eight awards to university-based scientists. Most often, those include group or team awards. Very often those are joint ARS, CSRS or Forest Service. When I say CSRS, I mean university-based people that are working together.

The same thing applies when the Agricultural Research Service puts in their awards for the departmental-level recognition. Sometimes there are university-based people that are on their awards at the very same time. And so this is what is done. I guess what I would have to admit to you, Mr. Chairman, is that we haven't particularly focused on the issue of better communication by scientists.

There is some interest in the scientific community now about going to something, on top of what I have already told you, That would recognize those scientists who are particularly good at communicating their results. And there are some awards now beginning to surface that focus on that issue.

Mr. PETERSON. Well, I would really encourage you to do that. I think that is one of our great failures in the research community, in that we are sitting on data far too long before we get it publicized in one of the prestigious manuals or publications.

Dr. JORDAN. One of the things that would help strengthen that, too, is that we have a number of programs, Mr. Chairman, that are cooperative with the Department of Energy, the National Science Foundation and the Department of Agriculture. These, also, come out and are announced and the results are more widely disseminated. But you have put your finger on one of the weaknesses. We need to do a better job of not only reporting among scientists, which is not too bad, but reporting to the general public.

Mr. SKEEN. Will the gentleman yield?

Mr. PETERSON. Yes, absolutely.

Mr. SKEEN. I think it is most interesting, we keep talking about technology transfer, but one of the things that I think has been causing a lot of the problems is the fact that the Federal Government, supports so much research and we don't know how to handle the proprietary rights involved in these situations. It has slowed the transfer of information and the dissemination, and we need to get a better system. Other countries do, I don't know why we can't.

Thank you.

Mr. PETERSON. And I think that is key to any successes we have in product development: exportation of not only the technology, but the product. I commend you for using the universities. We have incredible talent out there, and to not have used it in a real live, time-sensitive way would be a great loss. So I am very pleased, and, of course, I have a couple of universities who are very much involved with that. For example, the University of Florida, where they have done great work in that regard and I commend you for using those facilities.

Dr. JORDAN. There is a product in your bag there.

Mr. PETERSON. Yes. I already had noted that. I yield to Mr. Myers.

AGENCY OVERLAP

Mr. MYERS. Well, thank you, Mr. Chairman.

I share the concerns of our colleagues who have cross-examined the witness here this morning. I think we all are concerned about this, about the overlap. It has bothered me all the years I have been in Congress that there obviously is an overlap in research, and I have always wondered if it is really necessary.

I don't know why one agency couldn't really head up ARS as well as the Cooperative State Research Service, and I know that you can't agree with that, but it seems like maybe we would be served better in both services if we had one agency administrating both. I have never quite understood.

I understand the Secretary of Agriculture is considering realignment right now, and the fact that you are at least co-locating in some areas where they are contingent helps somewhat of avoiding that duplication. But the products—I am more concerned also about the fact that we are great researchers, and you certainly do a good job, you and ARS both, in developing new products, and this is one of the solutions I think to our agriculture economy, is to find more use for agricultural products, especially by-products. For that we thank you.

But it does disturb me that a product like this, how is it ever going to get out where industry is going to use it?

Dr. JORDAN. Actually, that is an industrial product.

Mr. MYERS. Sure, it is.

Dr. JORDAN. Of course, the reason it is in the bag is that it is out and being used now.

Mr. MYERS. It is?

Dr. JORDAN. Yes, sir.

Mr. MYERS. If I went to the lumberyard, would that be one of my choices, do you think?

Dr. JORDAN. I don't know whether it would be in your local one or not, but it certainly would be in the marketplace. We could put you in contact with the right person.

Mr. MYERS. Well, I am not doing that right now.

Dr. JORDAN. Can I come over Saturday and help?

Mr. MYERS. I may do it if you have got time.

How good are you at plastering? But this is one of the things we have had. Technology is great.

We are still the leading in the world, I think, in technology, but we are probably the poorest, as both my colleagues have discussed here, getting it out so industry can use it. This is something we do need.

PRICE COMPETITIVE PRODUCTS

Is there any effort being made now to make sure that these products are advertised? Are they price competitive?

Maybe we develop—I will use this as an example here. Is that price competitive with Sematech, some of the others?

Dr. JORDAN. Many of these are fast becoming price competitive. That is part of the research portion of it. You have authorized a small business innovation research program. It is growing now to 1.5 percent, moving towards 2 percent of our extramural research base. I am one of the persons, Congressman, that originally thought this was just going to drain resources off of an already tight budget.

Today I would say to you, sir, that anyone who wanted to stop this program, I would fight it to the death. Because the results that have come out of it are absolutely phenomenal in terms of what has occurred in the real world.

A number of them you will see in your bag. A number of others that I could focus on include the 911 service, for example, in the rural community, rural development area. The 911 service number is taken for granted in urban areas. The cost of it in terms of rural communities is just absolutely out of whack. And as a result of that, it is not available in every rural community.

What a group in Minnesota have done is to design a much smaller and cheaper tandem switch that allows, at a much lower cost, the involvement of the 911 system, and the complete detail of information that needs to be made available to make that work in rural communities. That is an interesting way of going about research.

You wouldn't normally think of it in agricultural research, but obviously it focuses on rural communities, and the quality of life in rural communities. There are a number of examples of that.

For example, multiple use of water for both mariculture and oyster growing, and freshwater shrimp and oyster.

FRESHWATER SHRIMP AND OYSTERS

Mr. MYERS. Fresh water shrimp and oyster?

Dr. JORDAN. Well, this particular project is focused; one in Hawaii and one in the Chesapeake Bay. This is more in somewhat, saline water.

But in any case, many of these small business innovative research projects have scientists associated with them, and they make enormous progress. They also do it on a fairly low overhead. They are constrained by the same 14 percent. Those are some of the people that are turning us down for the overhead costs.

Mr. MYERS. As I recall a few years ago, there was discussion about fresh water oysters and fresh water shrimp. I just wondered what ever happened to that. I think it was a study that you folks were conducting someplace.

Dr. JORDAN. I will be glad to provide information on that study for the record.

[The information follows:]

FRESHWATER SHRIMP AND OYSTERS

The Multi-cropping Stategies Special Grant focused on the coproduction of marine shrimp and marine oysters in Hawaii. Water from shrimp production systems passes though oyster production systems producing a secondary crop and at the same time improving water quality. This system results in increased shrimp production as well as a second crop, the oysters. The production of pearl oysters has also been evaluated in these systems. The Special Grant indicated commercial potential and led to the funding of a Small Business Innovation Research grant project to a private company in Hawaii.

There has been research funded on freshwater shrimp in Mississippi through a Special Grant at Mississippi State University. The research is aimed at improving profitability for freshwater shrimp production through improved management strategies and alternative production systems. Stocking rates, supplemental feeding, grading, and harvesting strategies have been evaluated. Research findings are currently being field tested in large commercial production systems. This research program does not include any work with marine oysters.

All cultured oysters are cultivated in marine or brackish water systems, not freshwater.

NEW TECHNOLOGY

Mr. MYERS. I think it was a State research project. This product here, think of all the insulation we use, cardboard boxes made out of wood fiber, paper, but the by-products of corn and other agricultural products it could be. So there is a great opportunity here, it seems to me, and this is one area that will save agriculture.

Years ago when I worked for a living, I was a banker and a farmer, and Earl Butz, I used to get Earl Butz to speak to the group once a year, the agriculture outlook, and Earl would say, "Well, now," he said, "Within 10 years the American farmer will be up in blue heaven here. We are going to be unable to produce all the food the world is going to need." I often remind Earl, he is still a constituent of mine. Earl, that was 40 years ago you were telling me.

Dr. JORDAN. When is that coming, huh?

Mr. MYERS. Technology has stayed ahead. Soybeans, is one area we haven't increased production like we should to be competitive in the world, against other oils and protein. But in any event, technology has kept ahead of the need, and the rest of the world, my son-in-law is down there raising cotton and soybeans now. But anyway, there is a lot of use for these products. But applied technology is one area we still just don't seem to be getting it out.

Dr. JORDAN. We are increasing the effort, though, Mr. Myers. As you well know, the Agricultural Research Service has a major effort in outreach and putting out a lot of CRADAs, and so on, and hoping to strengthen that. We have the SBIR program. We have spawned off another one that you are going to listen to later today in terms of the AARC program for commercialization. Extension is packaging and delivering information about these new things, and in an ever-increasing amount. However, it needs to be increased and improved.

There is no doubt about it. I want to emphasize for you, sir, that all of the agencies that you are interested in in this arena are putting enormous efforts behind this now, and that is really one of the areas in which the Assistant Secretary for Science and Education brings all of those agencies effectively together.

Even if they are in separate boxes, ARS, CSRS, Extension, the Assistant Secretary for Science and Education brings them together in a coordinated, executed plan. This is important for you to know, what has been happening, particularly over the last two or three years.

Mr. MYERS. Wouldn't the university setting be the proper place to put this distribution of technology, applied technology, getting it out so industry can use it?

Dr. JORDAN. It certainly is one of the major areas; yes, sir.

Mr. MYERS. It would seem that the State universities would be the proper place to put a distribution center, whatever you call it, for information and for product technology.

Dr. JORDAN. Of course, we were fortunate enough in ARS to have utilization laboratories for a number of years. Their direction was refocused for a while and so on, but they are back on that track again, too, sir.

TAXOL

Mr. MYERS. Well, one of the things that—I hope, Ms. DeLauro will be here, she was talking about taxol yesterday, and we were told you had some information about taxol. I am sure you were alerted to this.

What can you tell us about this?

Dr. JORDAN. Ol' Miss. We had a project involving the University of Mississippi and the Zelenka Nursery in Michigan.

Mr. MYERS. What is happening on that?

Dr. JORDAN. The issue on this one turned out to be very, very good indeed. We produced and delivered 40,000 pounds of dried ornamental Taxus. These are the trimmings from the ornamental Taxus. This was a program jointly sponsored. We partnered with the National Cancer Institute. They put $250,000 behind it. We put an additional $60,000 behind it and delivered these materials.

There are perhaps two to three times as much taxol coming out of the trimmings as we were getting from bark from the Pacific yew tree.

Mr. MYERS. It has made it just as effective in the treatment of ovarian cancer?

Dr. JORDAN. Oh, yes. In addition to that, of course, many research advances have been made, and one of the things that has occurred is that you can derive from other plants the compounds that are close in structure to taxol. In the laboratories the compounds can also be modified to make taxol. That is looking very promising as a possibility, a partial synthesis you might say, not from the ground up, necessarily, but partial synthesis in another product. This is extremely promising, and the beauty of this is that the price of taxol should drop markedly as a result of it.

Mr. MYERS. Yesterday it seemed that we were waiting for a sense of this, and while there is no expectation of it happening right away, in the meantime many, many women may be suffering and in need of taxol. I see no reason why we should wait, if you know how to do it now and can reduce it.

Dr. JORDAN. I think Bristol-Myers Squibb is really into this in a very intense effort. There are laboratories, particularly in England, that are working on the de novo synthesis, synthesis starting with raw materials in the laboratory, but it is also very promising that you can modify other compounds to make them into taxol.

Mr. MYERS. It would seem to me it would be senseless to wait when we can go to this and we know how to do them now.

Dr. JORDAN. That is right.

Mr. MYERS. We are moving forward on the program then?

Dr. JORDAN. That is right. And NCI is really the baton holder in this case, and we are all working together. Yes, we are. I am particularly interested in that, too, Mr. Myers. My wife was diagnosed last fall as having ovarian cancer, so I have an even more intense interest in this than I might have had otherwise.

Mr. MYERS. Well, my wife has had three cancers in three years, one of them has not been ovarian, but—she can't have, she doesn't have any ovaries left. We took care of that a year ago.

Dr. JORDAN. Let me say something that is very useful about taxol. It is not only useful for ovarian cancer, but seems to be very promising for breast cancer and perhaps other kinds of cancer, because of its function. The way it works is to slow down the time frame in which cells reproduce, and, therefore, they are more susceptible to any of the other treatments that are given with it, the chemical treatments, the Cytoxan or whatever else is given, even the radiation. It holds the cell at a more susceptible phase in its development. That is the beauty of it. So from my point of view as a chemist, I would say it may be useful across a wide range of cancers, not just the ovarian cancers and the breast cancers that we started with.

Mr. MYERS. I have studied cancer a lot. Is there toxicity associated with taxol?

Dr. JORDAN. Yes, taxol is quite toxic. In fact, the one thing you can almost guarantee, is that you will not have any hair when you get done with it.

Mr. MYERS. Well, of course with certain chemicals used in treatment of cancer——

Dr. JORDAN. Well, Sisplatnin and Cytoxan.

Mr. MYERS. Does taxol kill cells or just slow down the reproduction of cells?

Dr. JORDAN. It slows down the reproduction, the rate at which they reproduce and holds them in their most labile stage for a longer period of time.

Mr. MYERS. It seems to be most effective in treatment of ovarian cancer. I hope your wife was diagnosed early enough, but so often ovarian cancer is so often late in diagnosis.

Dr. JORDAN. You are absolutely correct. It is often late. So this looks like it could be a real, real boon to medicine and it is agriculture's contribution to health.

PEER REVIEW PROCESS

Mr. MYERS. One last question about the peer process that you had a discussion with the Chairman about and Mr. Skeen. We in Congress are frequently criticized, especially the appropriations process, because sometimes we bypass your peer review and use our own peer review process here. In your peer or merit process, what would be a typical makeup of a panel? Where would they come from for these merit reviews?

Dr. JORDAN. The most common makeup would be scientists with a strong background in the scientific discipline being addressed. But often it may involve a sociological impact arena, and so someone with that dimension may also be a part of it. It may also involve, particularly in our Sustainable Agriculture Research and Education Program, a translator, a farmer or rancher who may be involved in using the results, like the rotational systems, that are being proposed out of that program, and so we may have people from that kind of a background.

We will also often have somebody from another agency that will have a technical background. But basically it is people picked because they have a particular talent or background that contributes to the answer of the quality of this program. I must say, Mr. Myers, that any time we run into trouble on a project that looks like it is not going to come clean, and we have headed up here to talk with Members of the Congress, never has Congress or a Congress Member said I don't care, you go ahead and do it anyway.

So in the sense, you always do listen to us in the final result. And the direction that that project may go may be somewhat different because of reasons found in that review system. So in one sense you could say that we try to back you up. Once you have decided you want to do this particular thing, we try to back you up.

Mr. MYERS. Most of the conflict we have here is not in the selection of what the process shall be, because we are not technicians, but rather getting it started someplace. And this is where—our problem usually comes with the authorizing committee who want to spend two or three years studying where they are going to do it, and we get impatient here, we decided what is the use of waiting all this time, let's go ahead and get started on it. I think that is where our conflict comes from.

It is not that we are trying to tell you what process usually, but it is just to get it started someplace, get it off the center. The other committee across the hall here, I am the only one that served on the committee now, used to have old Admiral who came in with a baby, and I called him—he said, the United States is the greatest country in the world to study. We study everything, but we never do anything, he said we become a non-doer, and I had to kind of agree with him.

Dr. JORDAN. I think the other argument in terms of priorities is, is that as important as something else, and I am sure that comes up in your discussions all the time.

Mr. MYERS. But we use our own peers and we have staff, too, and we get the input from the various committees, and we find sometimes that we are tired of waiting, we are going to go ahead and do it, and often that is the case, with the authorizing committees that none of us serve on. But we get inpatient, so we kind of move ahead, but we try to use the best technology we have. So it is often a criticism. But I wondered how—you decide what university? The peer process decides the process, and then what university shall get it?

COMPETITIVE GRANTS PROGRAM

Dr. JORDAN. In the competitive grants program, we advertise our requests for proposals, and this announces broadly to the scientific community that this is a problem in which we wish to put some resources. And you, therefore, are free to send, under the guidelines identified under the RFP, in a proposal. And then that proposal, in competition with others that all have arrived by a certain deadline, are reviewed, and a panel of experts may rank them from one to however many proposals are received and go down that list as far as they can in terms of funding at a given time.

The critical thing on a peer review or a merit review program, of course, is to be sure that the right people are on the panel, and that is the real trick. And do we hit it all the time? No, sir, we don't.

Do we hit it most of the time? I believe we do. I think we do a remarkably good job of it, and that is why we go to so many ad hoc reviewers to get their feedback. So from the executive point of view, things that we don't recommend in the President's budget are simply a matter of do we have another way we can do this, or can we cover them another way and so on. So it is a matter of priorities. It is not a matter of saying that that is bad.

Mr. MYERS. Well, the problem I have had, and this will be my last observation, is that the top 20 or 25 so-called premiere universities seem to get about 60 percent of awards, and there are a lot of other universities around the country who are just as capable and the researchers do just as good a job, and maybe relate a little closer to the people who would really use the product that was produced. That is the objection I have. Would you put in the record what universities got these peer review awards the last year?

Dr. JORDAN. We would be pleased to provide a list of 1992 recipients of National Research Initiative Competitive Grants.

[The information follows:]

National Research Initiative Competitive Grants

A listing of all recipients of 1992 National Research Initiative Competitive Grants follows.

National Research Initiative Competitive Grants
Fiscal Year 1992 Recipients
(In Dollars)

State/Recipient	Fiscal Year 1992 Actual
ALASKA	
University of Alaska, Fairbanks	$18,759
ALABAMA	
Auburn University	792,380
ARIZONA	
University of Arizona	2,187,147
Arizona State University	240,000
Northern Arizona University	399,160
ARKANSAS	
University of Arkansas	506,252
University of Arkansas for Medical Sciences, Little Rock	120,000
CALIFORNIA	
University of California, Davis	6,336,712
University of California, Berkeley	1,654,400
San Diego State University	100,000
San Francisco State University	170,167
University of California, Santa Barbara	180,000
University of California, San Diego	390,000
University of California, San Francisco	240,000
University of California, Santa Cruz	10,000
University of California, Riverside	1,380,000
University of California, Los Angeles	115,000
Rancho Santa Ana Botanic Garden	210,000
Research Institute of Scripps Clinic	69,000
Beckman Research Institute of the City of Hope	150,000
California State University, Hayward	50,000
California Polytechnic State University	49,740
Keith D. Allen	70,000
Elena del Campillo	93,000
Daniel F. Ortiz	84,300
USDA, ARS Pacific West Area	295,044
COLORADO	
Colorado State University	1,520,342
University of Colorado, Colorado Springs	90,000
University of Colorado Health Sciences Center, Denver	148,401
USDA, ARS Northern Plains Area	149,000
CONNECTICUT	
Connecticut Agricultural Experiment Station	172,500
University of Connecticut, Storrs	432,588
Yale University	328,000
DELAWARE	
University of Delaware	250,000
DISTRICT OF COLUMBIA	
Georgetown University	180,000
USDA, ERS, ARED	134,091
FLORIDA	
Florida State University	120,000
University of Florida	2,470,065
University of South Florida	125,000
GEORGIA	
University of Georgia, Athens	2,205,561
USDA, ARS South Atlantic Area	750,000
Mercer University	49,992
Institute of Paper Science & Technology	102,000

State/Recipient	Fiscal Year 1992 Actual
HAWAII	
University of Hawaii	516,754
IDAHO	
University of Idaho	494,935
ILLINOIS	
Illinois State University	200,000
Loyola University of Chicago	107,925
Northern Illinois University	120,000
Northwestern University	50,000
University of Illinois, Chicago	65,000
University of Illinois, Urbana	3,321,485
USDA, ARS Mid-West Area	938,500
INDIANA	
Butler University	50,000
Indiana University	45,979
Purdue University	2,269,491
IOWA	
Iowa State University	1,795,926
University of Iowa	412,000
Cornell College	49,539
Botanical Society of America	2,000
KANSAS	
Kansas State University	1,273,995
University of Kansas Medical Center, Kansas City	6,005
KENTUCKY	
University of Louisville	210,000
University of Kentucky	734,174
LOUISIANA	
Louisiana State University & A&M College	412,000
Louisiana State University Medical Center, Shreveport	200,000
Southern University and A&M College, Baton Rouge	10,880
USDA, Forest Service Southern Forest Experiment Station	150,000
MAINE	
University of Maine	483,092
Colby College	49,992
MARYLAND	
University of Maryland	665,663
Uniformed Service University of the Health Sciences	140,000
American Society for Cell Biology	12,500
USDA, ARS Beltsville Area	588,000
Advanced Bioscience Lab, Inc.	100,000
MASSACHUSETTS	
University of Massachusetts	429,000
Boston College	60,000
Boston University	140,000
Tufts University	453,105
Harvard University	338,000
Massachusetts General Hospital	325,000
Lawrence J. Zwiebel	86,400
MICHIGAN	
Central Michigan University	49,973
Michigan State University	2,148,040
Michigan Technological University	295,000
University of Michigan	844,167
MINNESOTA	
University of Minnesota	1,730,350
MISSISSIPPI	
Mississippi State University	455,124
University of Southern Mississippi	63,900
University of Mississippi Medical Center	50,000

State/Recipient	Fiscal Year 1992 Actual
MISSOURI	
University of Missouri	2,315,697
Washington University	520,000
Monsanto Agricultural Company	168,000
MONTANA	
Montana State University	687,287
University of Montana	220,000
NEBRASKA	
University of Nebraska	1,175,414
NEW HAMPSHIRE	
University of New Hampshire	204,111
Dartmouth College	180,000
NEW JERSEY	
Rutgers, The State University	1,606,900
NEW MEXICO	
New Mexico State University	459,875
NEW YORK	
Cornell University	3,714,021
State University of New York, Albany	654,780
State University of New York, Buffalo	10,000
University of Rochester	200,000
Boyce Thompson Institute	360,000
Rensselaer Polytechnic	100,000
Cold Spring Harbor Lab	138,000
Syracuse University	275,000
New York University	2,000
Vassar College	84,544
State University of Binghamton	50,000
Wells College	50,000
NORTH CAROLINA	
North Carolina State University	2,232,525
University of North Carolina, Greensboro	243,611
University of North Carolina, Chapel Hill	239,560
Bowman Gray School of Medicine at Wake Forest University	200,000
Duke University	409,300
East Carolina University	71,902
James D. Bever	82,400
NORTH DAKOTA	
North Dakota State University	472,224
OHIO	
Ohio State University	1,485,984
Ohio University	200,000
Case Western Reserve University	96,000
University of Dayton	100,000
Miami University	102,000
Bowling Green State University	110,000
Children's Hospital Medical Center	186,839
OKLAHOMA	
Oklahoma State University	976,159
University of Oklahoma	110,000
OREGON	
Oregon State University	2,387,029
Reed College	120,000
PENNSYLVANIA	
Pennsylvania State University	735,970
Duquesne University	50,000
University of Pennsylvania	515,000
USDA, ARS North Atlantic Area	225,000
University of Pittsburg	185,000
Swarthmore College	110,000

State/Recipient	Fiscal Year 1992 Actual
RHODE ISLAND	
Gordon Research Conference	22,600
University of Rhode Island	261,296
SOUTH CAROLINA	
University of South Carolina	34,056
Clemson University	548,327
Medical University of South Carolina	265,000
SOUTH DAKOTA	
South Dakota State University	656,879
TENNESSEE	
Vanderbilt University	5,000
University of Tennessee, Knoxville	1,732,913
TEXAS	
Texas Tech University	366,248
University of Texas, Austin	398,000
University of Texas Health Science Center	130,000
Southwest Texas State University	170,000
Baylor College of Medicine	100,000
Rice University	280,000
Prairie View A&M University	50,000
University of Texas Southwestern Medical Center at Dallas	520,000
Texas A&M Research Foundation	3,354,842
UTAH	
Utah State University	613,500
University of Utah	600,000
VERMONT	
University of Vermont	389,812
VIRGINIA	
Virginia Polytechnic Institute & State University	844,165
WASHINGTON	
Washington State University	835,000
University of Washington	1,004,200
WEST VIRGINIA	
West Virginia University	444,387
WISCONSIN	
University of Wisconsin, Madison	4,436,535
Forest Service, Forest Products Laboratory	710,000
Marquette University	100,000
WYOMING	
University of Wyoming	360,963
Total	92,138,350
Federal administration (4%)	3,900,000
Small Business Act	1,170,000
Biotechnology Risk Assessment	291,650
Total	97,500,000

GRANT RECIPIENTS

Dr. JORDAN. We would also like to share with you some of our own observations. Namely, that the relative proportion of high quality sciences in institutions, that those stronger or so-called stronger institutions based upon the criteria that you are just speaking of, often don't do as well on a batting average in our peer review program as the smaller institutions. There are two reasons for that.

One reason is that we put at least 10 percent of our National Research Initiative funds into institutions that do not have strong track records of competing within agriculture. Some of those States that do well are amazed that they do not only because they have little pull, but also because they win in the bigger competition. So when I say at least 10 percent, you are going to say, hey, Patrick, we directed you to put 10 percent. We didn't tell you to put more than 10 percent.

The reason it turns out to be more than 10 percent almost every year is because they are very competitive in the other panels as well. More competitive than they think they are. So perhaps it would be very helpful, and I will be more than delighted, Mr. Myers, for you to have some reference material. We can summarize it for you by State in the red book that we hand in annually that has all the competitive grants. All of the panelists are named at the end of the year, so that you know who they are.

Mr. MYERS. Oh, that is in here, too?

Dr. JORDAN. Yes, sir. I think at times people wonder whether there is a group of people with black hoods over their heads or something that make all these decisions. When the panels are selected, I should share with you the fact that our chief scientist, Dr. Kelman, would tell you that it is a tough set of hurdles to get through. When they finally get approved, I approve them personally myself, I require them to tell me something about the sizes of institutions represented, the geography of the nation involved, the criteria that is used and to what extent it is used, Ethnic background, gender, the whole ramification so that our panels can more reflect the parts of America.

Mr. MYERS. Well, I don't know if I can agree with that analogy, to be quite honest with you. I think when it comes to research, I have often said if we only had a million dollars to spend in this Committee, I think it should be spent on research. I think it is that important to agriculture and to our consumers.

The thing I am concerned about, first making sure the university that does get the award, is capable of doing the job, and secondly, get it started. I don't think necessarily we should ever try to dictate, but the impatience we get is the fact nothing is being done, so we finally say let's go ahead and get the job done while you people study it. This is the reason I have a concern about this.

But I know there is good research done at Princeton and California Berkeley, but there are a lot of other universities that don't have the prestige that those universities have that can do just as capable a job.

Dr. JORDAN. In fact, in agriculture, there are other institutions that may have a better background, and so we do that.

Mr. MYERS. Let me emphasize at the same time that we never, ever, ever sacrifice quality. That is the number one criteria. That is the number one criteria.

Thank you for your testimony, the job you are doing. Research is so vital to our country to be competitive in the world and agriculture to be competitive in our own country, so thank you for the job you are doing, but do the best job you can in making sure that industry gets the product.

Thank you for the job you are doing.

NATIONAL RESEARCH INITIATIVE

The National Research Initiative research program—NRI—was expanded last year to include two new areas—food processing and value-added research and markets, trade and policy. Please comment on the nature of the research undertaken in these new areas. Do you foresee expanding these areas?

Dr. JORDAN. In the area of food processing and value-added research, the NRI supported investigations in both food and non-food products including wood and wood based materials. Proposals were solicited in two general areas: research to increase the understanding of physical, chemical and biological properties of food products and agricultural materials essential for enhancing quality of food and non-food products; and to develop new processes for better utilization and more efficient conversion of agricultural materials with resultant increases in value.

Grants were made on processing/preservation methods to extend the shelf-life and maintain quality of food products—increasing their value in the marketplace—fundamental studies of the characteristics of food components—e.g., fats, proteins, starches—related to the development of new processes and products, improved sensors and nondestructive testing methods to assist in processing and handling of foods, processing methods to increase the nutrient value and safety of foods and development of new and improved processes—e.g., milling, extrusion, drying, fermentation processes. For example, one project will model the moisture and absorption of fat in foods during the frying process, leading to more efficient frying processes and more healthful food.

Examples of research in the non-food area included extraction of valuable compounds—e.g., oils—from agricultural materials, development of processes for conversion of biomass and agricultural and food wastes to industrial commodities—polymers, animal feed, industrial chemicals, pharmaceuticals—new uses for underutilized hides—e.g, new composite materials—and development of new fibers from agricultural materials.

The Markets, Trade, and Rural Development Program subcomponent concerned with Market Assessment, Competitiveness, and Technology Assessment provided support for research that was designed to assess the size of potential international markets for agricultural, fish, and forest commodities as well as value-added products that could be exported from the United States. The grants awarded included proposals to assess impacts of the North Ameri-

can Free Trade Agreement; to determine the competitiveness of a variety of United States agricultural and value-added food and forest products in global markets; to evaluate the impacts of food, agriculture, and environment programs, market structure, firm strategies on U.S. competitiveness; and to examine technology assessment methods for their use to evaluate the impacts of new agricultural and processing techniques.

In the program on Rural Development, research was supported that was concerned with the improvement and economic well-being of rural families and communities, the identification of forces that influence social and economic viability and studies that emphasize the need to diversify economies of rural areas. One study will determine the extent to which rural firms and workers are affected by minimum wage laws compared to their urban counterparts. Results will supply information on how minimum wages have affected the structure of non-farm families which rely on off-farm jobs. The study has important implications for not only the economy of rural areas but also the sustainability of farms as an economic enterprise. A second study will identify factors that affect the spillover of growth from metropolitan to non-metro areas and examine the implications of fringe area growth for both urban and rural policy formation and evaluation. There is a need to improve the acquisition and utility of public data series needed for policy analysis and other official purposes. A third study will re-examine the use of county level statistical data and attempt to develop new sub-county units that more accurately reflect the structure of U.S. settlement patterns. This work is of special importance to rural areas which often get submerged in large aggregates for statistical purposes and thus lose representation in the policy process. A fourth study will evaluate the opportunity for entrepreneurial initiatives among Mexican Americans in the southwest United States. This population is characterized by low levels of human capital, dependence on agricultural employment and high rates of poverty, all of which mitigate against entrepreneurship. However, the opportunity to create new "ethnic enterprises" has been noted and the study will further investigate the potential for these to flourish.

We think that the above programs are in areas that can expand in the future, depending on the availability of funding.

Mr. MYERS. What is the general status and adequacy of food processing, manufacturing and safety research in the U.S. related to the nation's needs.

Dr. JORDAN. With respect to the general status and adequacy of the food processing, manufacturing and food safety research to meet current and future needs of the nation there is a pressing need to enhance the competitive value and quality of U.S. food products. European countries sell about 75 percent of their agricultural output as value-added consumer products, while only one-third of U.S. agricultural products are high-value-added products. Currently, the U.S. exports over 50 percent of its agricultural and forestry output as bulk commodities and less than 30 percent of U.S. food exports are considered as high-value-added products.

For the agricultural research system as a whole, food science/technology research declined from 5.2 percent of total system expenditures in 1981 to 4.7 percent of system expenditures in 1991,

primarily due to relative reductions in this area by USDA intramural agencies. About $44.8 million was expended by universities and $35.7 million by USDA intramural agencies for food science/technology research in 1981. This had increased to $90.0 million and $42.6 million, respectively, in 1991. In view of the potential contributions to increased competitiveness, there is an opportunity for expansion of research emphasis in the area of food processing and manufacturing. The continuing concern for food safety also has called attention to the need to consider new initiatives in diagnostic and related technologies to ensure food safety standards.

Mr. MYERS. How is the NRI program managed to ensure that it is focused on the truly critical and high priority problems of agriculture. How is this focus maintained?

Dr. JORDAN. The following procedures are being followed to ensure that the NRI program is focused on the truly critical and high priority problems of agriculture.

Two series of workshops have been scheduled with various commodity, environmental, and consumer groups at which an opportunity is provided for the participants to provide us with their perceptions of the priorities in their respective fields. A third series of workshops are in progress this spring. We also receive and encourage comments in the Requests for Proposals from various scientific societies and special interest groups such as those representing Sustainable Agriculture organizations.

Prior to the preparation of the Request for Proposals in 1992, panels with representatives from each of the research agencies of the USDA and the Forest Service examined the Requests for Proposals and prepared suggestions for revisions.

Evaluation criteria considered by members of review panels and ad hoc reviewers emphasize the importance of the relevance of all proposals to a sustainable agricultural and natural resource system.

Suggestions were also received from the Experiment Station Committee on Organization and Policy. The advice from the various sources was collated and carefully considered by the Chief Scientist and staff of the National Research Initiative Competitive Grants Program to prepare the draft of the 1993 Request for Proposals. As a final step, the Board of Directors of the NRI, composed of the key agency administrators, reviewed the proposed Request for Proposals as a final step in the process of ensuring focus on primary objectives.

INDIRECT COSTS

Mr. MYERS. In your opinion, what will be the new Administration's position on the USDA indirect cost cap on competitive grants? Do you believe that the indirect cost cap on USDA grants should be treated the same as research from other Federal agencies.

Dr. JORDAN. My understanding is that the Administration's position on overhead costs will be included in revisions to OMB Circular A-21. I believe that the indirect cost cap on USDA grants should be treated the same as research from other Federal agencies. The costs of research regardless of source of funding are the

same. A lower cap on USDA programs can create a bias against seeking USDA grants vs. other Federal grants with a loss of the best scientists addressing agriculture problems.

GENOME MAPPING

Mr. MYERS. What progress has been made in developing molecular genetic maps in crop plants, particularly with regard to barley? What efforts will be made to ensure that any progress in genome mapping is applied to crop improvement?

Dr. JORDAN. The Cooperative State Research Service is administering support for plant genome mapping through several funding authorities including the National Research Initiative Competitive Grants Program, Special Research Grants, and formula funding. Progress is being made on many fronts. The barley genome consortium has devoted itself to making sure that the discoveries are applied to real world problems. They are focusing on the identification of quantitative genetics traits such as malting quality, which are of major interest to barley-improvement scientists. Heretofore, the identification of superior progeny for malting quality could only be identified through complicated diastatic assay. The intent of this research project is to identify molecular probes that can be used to quickly check for superior genetic combinations, and thus rapidly advance superior genetic materials. To assure application of the discoveries we maintain direct communication with the project's principal investigator and carefully review annual reports of accomplishments from the project.

INDIANA UNIVERSITY CENTER FOR MOLECULAR AND CELLULAR BIOLOGY

Mr. MYERS. What is the status of the Indiana University Center for Molecular and Cellular Biology? When can the university expect the funding that was provided by this Committee for fiscal year 1993?

Dr. JORDAN. An architect was hired and program planning was completed during the past year. Additional consultants are in the process of being hired to begin the schematic design phase of the project, and current occupants of Myers Hall will be temporarily relocated to other facilities so that remodeling of Myers Hall can begin. The start of construction is scheduled for March 1994.

The fiscal year 1993 grant application is undergoing final pre-award evaluation in CSRS. The award should be made within the next few weeks.

ALTERNATIVE AGRICULTURE

Mr. PETERSON. Mr. Smith, would you like to ask questions?

Mr. SMITH. We have got some interest, as you know, in Alternative Agricultural Research and Commercialization Programs. Frankly, I think some people are expecting too much of it, but anyway, that is what people want to do. How is that coming?

Dr. JORDAN. There are probably more discussions in this particular arena, Mr. Smith, than almost any other within the research community and in the leadership of research and extension, both, in the USDA. Our own program in alternatives, which focuses heavily on crambe and rapeseed and guayule, and also alternatives

in terms of aquaculture. There are also alternatives in terms of completely new plants, such as one that I showed before you arrived, which I am sure would be of interest to you in your part of the country, fiber flax, a different kind of flax entirely. We used to grow it, we had it for years and years and years.

And so the headway being made in this regard in our own agency, plus Agricultural Research Service, plus Extension Service, is most impressive, and the fact that all of these agencies are working together in a common plan and exchanging ideas and people as they need to ship them back and forth to get the job done is impressive.

Mr. SMITH. What kind of criteria are you using to determine which proposals to accept?

Dr. JORDAN. One of the criteria is, is there some probability of success or, alternatively, if that is not a very high criteria does the value of success warrant the risk to be taken on the way?

Mr. SMITH. What would success be?

Dr. JORDAN. Whether the objectives of that proposal and program are likely to be achievable. Do the scientists that are proposing it have the background, do they have the——

Mr. SMITH. I guess I am asking, what is the ultimate objective? Is it to have an alternative crop that is salable? Is that the——

Dr. JORDAN. Yes, sir.

Mr. SMITH. That is the primary, ultimate objective?

Dr. JORDAN. Yes, sir. At first it may not be clear how valuable the alternative crop may be. For example, we don't know at the moment how valuable, dollar-wise, the fiber flax will be although we have economists working on it. If we put that in as an alternative, it is part of the criteria, yes, sir.

Mr. SMITH. Well, what is the other part of it.

Dr. JORDAN. What is the chance of success? Are you able to grow it in this part of the country? What would you have to do to make it different so that it could grow or develop and be successful.

Mr. SMITH. So the purpose, the ultimate objective in your criteria would indicate this is an alternative crop we could grow and sell?

Dr. JORDAN. And would it be economically feasible and environmentally benign. Yes, sir.

Mr. SMITH. Well, now you worked in another piece of criteria there.

Dr. JORDAN. Well, that is true, and we may not know that this soon, but that is one of the questions that we have to ask before it gets to the commercial——

Mr. SMITH. What kind of weight are you giving to that criteria?

Dr. JORDAN. If we had choices, we would obviously want to pay attention to those things that are likely to not contaminate.

GRANT CRITERIA

Mr. SMITH. Do you have a written list of criteria, or are these just something you carry around in your head?

Dr. JORDAN. I think maybe if I could, Mr. Smith, I would rather call upon my deputy in that area to respond.

Mr. SMITH. Okay. Dr. Kugler.

Dr. KUGLER. I am over here, sir. We are looking at the potential for large-scale production that will provide profits to the farmer, that will provide a viable and reliable supply of materials to the processor who can also make a profit. We can then provide that processed product to the marketplace at a sufficient enough level that money can be earned as that product is sold in a volume that will warrant manufacturing.

Mr. SMITH. Do you have a list, a written list of criteria so that people who are applying will know what your criteria happen to be?

Dr. KUGLER. We have criteria which we can provide to you, sir, and I believe that also the AARC program can provide you with a list of criteria that are quite similar.

Mr. SMITH. You believe they can. Don't we know whether or not they can.

Dr. O'CONNELL. Mr. Chairman, we represent the AARC program. We are going to be up next. We do have criteria. I think you are talking about the competitive program. We do have criteria and we will be listing that very shortly.

Mr. PETERSON. Would you state your name for the record?

Dr. O'CONNELL. I am Paul O'Connell, Director of the AARC Center.

Mr. SMITH. Okay. That is all I have.

Mr. PETERSON. Thank you, Mr. Chairman. I just have a real quick follow-up.

AWARDS PROGRAM

One, I would like for you to look at this awards program that we talked about and give me—you don't have to do this right now, I know you are going to have to do some work on this, but I would like to see if there is some way to create an awards program that does what I think should be done, and that is to stimulate exchange of scientific data.

ETHICAL CONCERNS

The other thing, just as an observation, Ol' Miss has a contract with Squibb. They are working with you and they are working with the other research center project. Is there a potential for double-dipping in this, or not, from the standpoint of doing the work for one and collecting from three?

Dr. JORDAN. We have been extremely careful about the issue of ethics as we move down through this funding effort. I think there is the potential, and that is why we paid attention to it. I think we have come to the judgment that the checks and balances are there to take care of it.

Mr. PETERSON. Okay. It seems to me that we have to be very careful about that. But I thank you for your testimony.

Mr. MYERS. May I, along that same line, are we doing enough with Squibb and Ol' Miss, are we putting enough money in that they can do the best job they can about expanding this program?

Dr. JORDAN. Yes, sir. I will say that we struggled, but we got enough, yes, sir.

Mr. MYERS. If you would advise us, because this is one area I think most of us are very much interested in.

Mr. PETERSON. We are only talking $60,000 on your part, right?

Dr. JORDAN. That is right, and $250,000 out of NCI.

Mr. MYERS. Well, is that enough?

Dr. JORDAN. Yes, it did the job.

Mr. MYERS. Good luck with your wife. We will remember her in our prayers.

Mr. PETERSON. I see we have our friend from New Mexico, or Arizona.

Mr. PASTOR. New Mexico, Arizona.

Mr. PETERSON. We are well represented in the southwest here. We can't keep you straight. Mr. Pastor.

Mr. MYERS. We are the ones with the irrigation systems.

Mr. PASTOR. Or lack of. Just a couple of questions.

First of all, thank you for all the goodies. I am enjoying this Committee, all these goodies every day, it looks like trick or treat here.

HIGHER EDUCATION

On page 11 where you talk about higher education, you mention how you have educational grants available, and you conduct efforts to attract outstanding scholars, particularly women and minorities, to universities. I think it was several weeks ago we had one of the agencies that conduct some research tell us that it seems that the universities are not as active in agricultural research, that their interest in agriculture may not be as great. And, as a result, we have witnessed a diminution of effort, at the university level, to attract students to study in the field of agriculture.

So the first question is very general in terms of what kind of outreach do you have in this particular program?

Dr. JORDAN. The institutions that participate with us certainly include the land grant institutions, but in addition to that, a number that are not of the land grant variety. In fact, 134 institutions of higher learning have agriculture colleges or major agricultural programs participating in the higher education arena with us. We have also focused heavily on trying to increase the pool size of highly qualified women and minorities in the agricultural sciences, and thus, a number of programs have been put into place, including the 1890 Institution Capacity Building Grants Program.

We are now working our way through some thoughts on what do we do in terms of increasing Hispanic involvement; and for us in agriculture, Mr. Pastor, the Oriental is a minority, in a sense. We do not have in agriculture anywhere near the proportion that is in the population.

Mr. PASTOR. And in the West you have many oriental families that are involved in agriculture.

Dr. JORDAN. That is right. And the Native American. And so all of these are areas of keen interest. And each successive Secretary of Agriculture that I have served has been just a little more intense in wanting to do something more in this regard than his predecessor.

So I think there is a reason to be very optimistic. What we are seeing is very interesting. When we first started with our peer

panels in the competitive grants program, trying to find minority and women scientists in some areas was extremely difficult.

The pressure that we have put over the last half-dozen years makes it so that virtually no panel now is formed without a substantial representation of women and minorities on it, all very well qualified.

OUTREACH PROGRAMS

Mr. PASTOR. I congratulate you on that. Who does the outreach? Does your agency do the outreach for these students, or do you fund the universities to do the outreach, or do you fund nonprofits that may have greater access to the population that you are targeting?

Dr. JORDAN. The basic group that we deal with is the institution, and we ask the institution to attract those students. It has a number of fallout benefits. For example, through the funds you provide to us, we fund about 63 new national need graduate fellows a year. That is not a lot when you stop and think about the whole country. But the impact in terms of attracting students to apply to that institution, and the move by the institution to find other resources to support those students has increased the overall quality of the student coming there.

We are also interested at the undergraduate level, and we have done a few things in terms of the secondary student, as well. We have got to begin to attract students much earlier if we are going to get them into the stream.

SCHOLARSHIP PROGRAMS

Mr. PASTOR. In some universities that I am familiar with, at least in the West, as in the pack of ten, you have a number of special scholarship programs that are geared to women and various minorities.

As an example, at the University of Arizona, ASU, USC, UCLA, they have Hispanic scholarship programs that match any contribution, allowing them to attract a greater number of students. Afro-Americans have similar programs, Native Americans and women.

Have you ever looked at this type of program as a possible resource, matching where you could enhance these scholarship programs by matching some of their funds. This approach could help attract students that are qualified and who have an interest in agriculture.

Dr. JORDAN. Again, in the proposal submitted by the institution, it may very well say that one of the reasons we should get your fellowship dollar is because we have the capacity to magnify the impact, and here are the data that it supports.

Mr. PASTOR. So the initiative has to come from the institution, as I heard you say?

Dr. JORDAN. That is correct.

Mr. PASTOR. Now, would it be maybe a little better to meet your objective if you were to encourage an institution to have such a scholarship program by matching this particular scholarship program. They would attract and identify qualified undergraduate or graduate students to participate, and take an interest in the agricultural sciences, what if you took the initiative? Do you think it might be more effective?

Dr. JORDAN. Well, we take the initiative in the sense of announcing the program, and I have a deputy in this area, Dr. Jane Coulter. Would we be able to spend a little time with you later on, Mr. Pastor?

Mr. PASTOR. Sure. I would be happy to.

Dr. JORDAN. We could lay out the entire dimensions of that program for you.

Mr. PASTOR. Maybe I could also encourage you to take the initiative to, say, provide the incentives where the institutions themselves would want to participate in your outreach. Because they are working to attract the students and may have already developed a network that could assist in attracting and educating our young men and women.

Dr. JORDAN. I think you would be impressed in how much we accomplish in that arena. We put on workshops annually around the country about how to apply for these programs and how to compete in them, and that is where we do a lot of the stimulus of institutions to do exactly what you are suggesting.

COTTON RESEARCH

Mr. PASTOR. Thank you. Also on page 13 you talk about the research you are supporting on pima cotton, and pima cotton is very important to us. You talk about higher yields and heat resistance. What other aspects of cotton research are you presently undertaking?

Dr. JORDAN. Among the highest areas of interest have been the biological control of pests, for example.

Mr. PASTOR. Okay.

Dr. JORDAN. As well as the ability to incorporate various kinds of cotton or other kinds of material into goods that can be used, alternatives, including flax and cotton mixes.

SWEET POTATO WHITEFLY RESEARCH

Mr. PASTOR. One of our problems right now in the southwest, and I say southwest, is due to the whitefly infestation. This insect likes cotton very much and it is going to other fruits and vegetables. Are you doing any research in that area?

Dr. JORDAN. In fact, one of the best examples of coordination among Federal agencies and the universities is the whitefly outbreak last year. We moved with extreme speed in the Agricultural Research Service, the Animal and Plant Health Inspection Service, the universities, including California, Arizona, Texas A&M, Florida and Georgia. They were all involved in that effort, and, of course, the Extension Service. A number of the techniques that have been developed include some fairly simple things.

For example, if you stop your harvest of the final bits of cotton, for example, two or three weeks early and let it lay fallow before you put in your vegetables, the movement of the sweet potato whitefly onto the vegetables is reduced more than 50 percent by a fairly simple technique like that.

If you weren't pulling too much off in the last two or three weeks, this makes a lot of sense.

Mr. PASTOR. They are saying go in early and go out early, the technique that they are using.

Dr. JORDAN. Yes, that is right.

Mr. PASTOR. The application of any insecticide or pesticide is also very difficult, because the pest attaches to the bottom of the leaf rather than at the top, so just the application of——

Dr. JORDAN. Well, you have to have something underneath that sprays up.

Mr. PASTOR. I guess our technology is not developed enough.

Dr. JORDAN. Oh, no, it is. In actuality, not only engineers, but also ARS has developed and worked on spray techniques for some crops that focus on that kind of technology. So adapting it to a particular use, of course, is in the next level of problem.

WATER QUALITY

Mr. PASTOR. The other interest I have is water. You know, we have tried in some areas to do drip irrigation in the desert, but it seems the soil content, the type of soil we find there, makes it very difficult. Yet, drip irrigation, because of cost of water, the lack of water, is something that we need to look at. Have you done any research?

Dr. JORDAN. There are a number of research projects, both in the university-based system and in ARS on trickle or drip irrigation. It has another distinct advantage, as you are probably well aware, Mr. Pastor, namely, that the accumulation of salinity is reduced and controlled under those conditions, so there are a lot of advantages to that approach.

CROP DEVELOPMENT

Mr. PASTOR. And the last question is, as you look to the future, you see NAFTA implemented, shifts probably in agriculture and types of crops we are going to be growing here and over there, do you see any new possibilities of crop development in the southwest?

Dr. JORDAN. I think I see even a broader view than that, if I may. If you were to go to the western United States and make a large goose egg on the whole continent, at the top of that you would have 20 percent of the world's potable water. At the bottom of that you would have a ready and available labor force.

And in between, you would have some of the most productive land that God ever put on this earth. And if you would kind of work those things together more easily, you might be absolutely amazed at the productivity and the capacity to provide agricultural products, both for industrial use and for food and fiber.

Mr. PASTOR. Do you have any specifics as you look into that goose egg?

Dr. JORDAN. Among the things is a wider range of vegetables, for example, new varieties, more resistance and so on. Also, fruits and vegetables that might be more shippable for longer periods of time that would retain their shelf life. I think there is a tremendous potential out there, and the scientists are doing quite a bit of planning in this arena.

Mr. PASTOR. Mr. Chairman, I guess we have got to get trade secrets. Thank you very much.

Mr. PETERSON. Thank you very much. I appreciate it.

Mr. Smith had a question.

SUSTAINABLE AGRICULTURE

Mr. SMITH. I have one or two questions on sustainable agriculture. I know you have been directed to spend the money so you have got to find a way to do it. But I look at these things that you have got in here about how you are looking into rotations of corn, soybeans and small grains and dividing pastures into paddocks, so they can be grazed on a rotational basis. Those are things we did back in the 1930s.

As a matter of fact, the Extension Service has a lot of bulletins on that which they distributed widely back in the 1930s. What is new?

Dr. JORDAN. I think in the sustainable arena, two things are new in that program. Some of it is new knowledge and new technologies that follow the same general theme that you have identified here. The second is the cooperative effort involving farmers, ranchers, agribusiness people, private nonprofit organizations, academicians, governmental scientists, putting this into a form that is, in fact, used by people.

I think it is the outreach and the packaging of it, as well. But to answer the first question on the technologies, Mr. Smith, maybe you would allow me to again turn to one of my deputies and give you a specific answer.

Dan or Dr. George Bird.

Dr. BIRD. Yes, sir. I would say that while these systems may seem like systems that we have used before, the knowledge that is being put into them is being used in a different way and is new. On the rotational grazing, what is being learned here is how to manage the grains and the legumes and mixtures so that they are at optimal heights with the nutrition value that is necessary for animals at that time. We are finding that some farms that are converting to this system are becoming more profitable, and also there is probably more time available in those farm families for some other activities that they do not have using some of the other systems.

The rotational system that we talked about there with the corn and the soybeans and the wheat and the legumes, this is basically a system that is being designed to reduce some risks to the environment in relation to soil runoff, soil erosion, the use of various chemicals. And so while these systems may seem like things that have been done in the past, the people that are trying them and using them on farms are using them in somewhat of a very different manner today, and it is really a very high technology system. It is just a different type of technology.

Mr. SMITH. I haven't heard anything new yet. We divided pastures into paddocks back when I was a little boy and some people had some sheep and they turned them in when they wanted to take their broad leaves down so the grass would be left and get them out the right day so that the grass would be available for the

cows. All this is old stuff. It is 60 years old. I haven't heard anything new.

I know you have to spend the money because there is a push around here to try to make you get into sustainable agriculture. But it seems to me that we ought to have a better way to spend the money.

Dr. JORDAN. One of the bottom lines on that, sir, is that in those rotational experiments, in some instances we reduce the input costs, particularly for pesticides, to virtually nothing.

Mr. SMITH. No question about that, but you also reduce the output. The money a producer gets back is what the farmer looks at, and if he can get more money back than he is saving on the inputs, he is going to do it.

Dr. JORDAN. And that is the balance that we are working on.

Mr. SMITH. They all do that. Every farmer does that, I mean everyone that stays in the farming business very long, he does that anyway. They reduced the amount of fertilizers being applied because they found out it didn't pay to put that extra fertilizer out. This program had nothing to do with it. That is all I have.

Dr. JORDAN. What we do now, though, is we try to do it with a cost-effective and environmentally benign answer coming out at the other end; that is correct.

Mr. PETERSON. A member of the subcommittee, Mrs. DeLauro, has questions she would like answered for the record.

[The questions and responses follow:]

RESEARCH GRANTS

Ms. DELAURO. In the President's economic proposal, "A Vision of Change for America," a recommendation has been put forward to reduce funding for the Special Research Grant Program and to compensate for this reduction through increased funding for the National Initiative for Research on Agriculture, Food and Environment (NRI). How would such a shift in program funding affect the types of research projects that CSRS could fund?

RESPONSE. The National Research Initiative provides a mechanism to define the highest priority issues of interest to producers, processors and consumers of agricultural products and then target funds to the most scientifically meritorious projects to address those needs. Priorities for the NRI are established with significant input from producers, industry, consumer groups and other users of research as well as scientists. Input from these sources is incorporated into Requests for Proposals. Results of NRI-supported research will have broad applicability and provides the basis for additional technological advances which can keep American producers competitive. Special grants which would be eliminated under the President's proposal could be funded through discretionary formula funds or could be submitted to the NRI for consideration.

COMPETITIVE GRANTS

Ms. DELAURO. In your written testimony, you state that in 1992 CSRS was able to "support approximately 15 percent of the funds requested" for NRI grants. Would you expect this percentage to rise with expanded NRI funds, or would you expect increased demand for NRI funding to offset any potential increase in CSRS' ability to support a greater percentage of the request funds?

RESPONSE. In view of the current overall decrease in funding at many institutions for research and the pressure at the state level for faculty at land-grant, public and private universities to seek federal funding, it is likely that expansion of funds allocated to the NRI could result in an increase in requests for funds. However, in fiscal year 1993, the requests for funding did not increase significantly for established programs and the total number of proposals in fact declined slightly. With increased funds it is possible that new programs currently not supported could be established, and there is likely to be an increased number of funding requests for these programs initially which would eventually stabilize.

Special Research Grants

Ms. DeLauro. Recently, I received a memorandum from Ronald W. Cotterill, Director of the Food Marketing Policy Center at the University of Connecticut, which has been funded through the Special Research Grant Program. I have attached a copy of this document. Mr. Cotterill takes issue with the statement in "A Vision for Change for America" that these grants "are not specifically authorized, competitively awarded, or peer reviewed." Could you please respond to Mr. Cotterill's arguments regarding the competitive and review processes as they apply to programs like the Food Marketing Policy Center?

Response. The Congress essentially serves as the subject review and selection panel that determines what problems and issues will be researched.

Special grants may be categorized into one of two general groups. One group consists of programmatic grants in response to problems requiring a sustained research effort to resolve. The Congress indicates the purpose of the appropriation but leaves the administration of the grant planning and recipient selection and grants processing to CSRS. For these grants, CSRS utilizes a competitive process very similar to that used by the National Research Initiative Competitive Grants Program. CSRS scientists prepare a solicitation request for proposals, organize outside peer review panels to select the best proposals, and oversee progress on the selected grants. An example is the Water Quality Special Grant Program.

The second group consists of grants for applied research where Congress identifies the recipient institution as well as establishing the grant objectives. The Food Marketing Policy Center grant is an example of one that falls in the latter category. Administration's policy, however, requires that other universities with similar programs be allowed to compete with the Food Marketing Policy Center for this grant.

CSRS solicits proposals from the designated recipient institutions and reviews them for merit, suitability of the research plan, problem solving approach, and progress. The institutions, at CSRS's request, peer review the proposals before submission to CSRS. In some instances, the institution conducts a competition to solicit proposals from their faculty and determines whom will receive grants through a peer review process.

Ms. DeLauro. In addition, Mr. Cotterill contends that the NRI programs do not represent a feasible alternative funding source for such general research efforts as the Food Marketing Policy Center at the University of Connecticut. Do you agree with this assessment? If so, are there changes that could be made in the NRI program to make it more appropriate for the type of research and research facilitation activities undertaken at the Food Marketing Policy Center? More generally, what changes need to be made in the NRI or other CSRS research programs to accommodate support of applied socioeconomic research to address critical national and regional issues?

Response. The overall funding for the NRI relative to the board array of topics to be addressed has limited involvement of the NRI in support of large awards to centers. Beginning in fiscal year 1992, the NRI has some funds dedicated to marketing and may be a potential source of funding for individual projects within the Food Marketing Policy Center. However, the funding level for this kind of research in the NRI currently is too low to suggest it could provide the overall support for the center that is currently coming from Special Research Grants. As the funding level for the NRI increases, the potential for larger projects and centers to win grants will improve.

Mr. Peterson. A Member of the Committee, Mr. Obey, has questions he would like answered for the record.

University of Wisconsin-Stevens Point

Mr. Obey. Following a very positive review by CSRS in 1992, Congress provided $86,000 in the CSRS Buildings and Facilities account of the fiscal year 1993 Rural Development and Agriculture Appropriations bill for initial construction of a building addition to the University of Wisconsin-Stevens Point College of Natural Resources. In fiscal year 1994, the College will be seeking $4,825,000 for completion of the project. The State of Wisconsin has already agreed to provide $5,989,000 in state matching funds.

I believe this is an excellent project and I would like your assessment of the merits of the project.

Response. The College of Natural Resources and the Biology Department at the University of Wisconsin-Stevens Point have been housed together in a building for

the past 20 years that was filled to physical capacity upon occupancy. The addition of new academic programs during the past five years, has constrained current space so that further expansion is impossible. At the same time, an increase in College faculty and staff created a further shortage of office space and resulted in the dispersal of personnel across the campus, thus reducing faculty interaction and operational efficiency. This project proposes to solve these problems by providing additional laboratory and specialized instructional space and offices for faculty and support staff, to permit the College to consolidate programmatic functions, take advantage of new technologies, and provide for a safer environment.

Mr. PETERSON. Any other questions? Thank you, Dr. Jordan, and your colleagues, for excellent testimony and we appreciate your patience here. We have kept you a long time. So the next panel, please.

Dr. Arthur Kelman
Chief Scientist, National Research Initiative
Competitive Grants Program (NRICGP)

Dr. Arthur Kelman was appointed Chief Scientist in the NRICGP of the Cooperative State Research Service in October 1991. He provides administrative guidance and scientific expertise to the NRICGP. He was born in Providence, Rhode Island and earned a B. S. Degree in Biology at the University of Rhode Island and M. S. and Ph.D. degrees in Plant Pathology at North Carolina State University. He was appointed Assistant Professor of Plant Pathology at North Carolina State University and after advancement to the rank of Professor was appointed a Reynolds Distinguished Professor of Plant Pathology. In 1965 he was invited to the University of Wisconsin-Madison as Chairman of the Department of Plant Pathology. After a ten year period in this position, he was appointed the L. R. Jones Distinguished Professor of Plant Pathology and subsequently was awarded the Wisconsin Alumni Research Foundation Senior Research Professorship in Plant Pathology and Bacteriology. He currently holds an appointment as University Distinguished Scholar in the Department of Plant Pathology, North Carolina State University. During his career he has made a major commitment to teaching undergraduates in introductory courses in plant pathology and forest pathology. Graduate instruction has included courses in disease physiology and biology of plant pathogenic bacteria.

Dr. Kelman was a visiting investigator at the Rockefeller Institute for Medical Research in New York City and a National Science Foundation Senior Postdoctoral Fellow in the Department of Biochemistry at Cambridge University in England. He is a Fellow of the American Phytopathological Society and a member of the National Academy of Sciences (NAS) and the American Academy of the Arts and Sciences. He has served as Chairman of Class VI, Applied Biology and Agricultural Sciences, and as a member of the Council of the NAS and as Chairman of the Division of Biological Sciences and the Board on Biology of the National Research Council. Among other awards, he has received the Stakman Award from the University of Minnesota, the Award of Distinction to the American Phytopathological Society, an Honorary Degree of Doctor of Science from the University of Rhode Island and four awards for excellence in teaching. He has served as President of the American Phytopathological Society and the International Society of Plant Pathology.

His principal research has been on bacterial diseases of plants with particular emphasis on mechanisms of disease induction, nature of disease resistance and role of calcium nutrition in resistance to enzymatic tissue degradation by bacteria.

COOPERATIVE STATE RESEARCH SERVICE

Statement of Dr. John Patrick Jordan, Administrator of the Cooperative State Research Service (CSRS) before the Subcommittee on Agriculture, Rural Development, Food and Drug Administration, and Related Agencies.

Mr. Chairman and Members of the Subcommittee: American agriculture is the envy of the world. As our nation's biggest industry, it is the most efficient agriculture in the world and remains a mainstay source of food and fiber for this country and much of the world. A major contributor to this success is the agriculture and forestry research carried out in the land-grant college system for well over a century. This remarkable idea created a Federal-State partnership in science and education to serve all the people and this system has done just that.

Through joint planning and scientific review of projects and programs, the Cooperative State Research Service focuses Federal resources on perennial and emerging problems in agriculture, related to the provisions of the Farm Bill and the priorities of the Joint Council on Food and Agricultural Sciences and the National Agricultural Research and Extension Users Advisory Board. CSRS programs span the continuum from fundamental research in the National Research Initiative to mission-focused work in our formula based and special grants programs to commercialization in our supplemental and alternative crops program. It is all targeted to priority needs of producers and consumers of food and fiber. The partnership between USDA and the university based research system is forged through CSRS. We do this in cooperation with all of the State and Territorial Agricultural Experiment Stations; the 1890 land-grant institutions,

including Tuskegee University; all of the Forestry Schools; and all of the Colleges of Veterinary Medicine in the United States. In addition to land-grant universities, there are other universities, not of the land-grant model, which are participants in the system. Together these institutions very effectively address regional and national needs in agricultural research and education as well as their particular State and local agendas.

The mission of CSRS is to advance science, technology and education in support of agriculture, forestry, people and communities through a partnership with the system of State Agricultural Experiment Stations, colleges, universities, and other public and private research and education organizations and in concert with the Secretary of Agriculture and intent of Congress. We accomplish this mission with a current CSRS ceiling of 230 staff-years, which supports a system of approximately 45,000 people.

CSRS operates under several legislative authorities which enable it to flexibly address agricultural research and education needs. These programs bring about inter-state cooperation and Federal-State collaboration in planning and carrying out a national program of agricultural research and education. The CSRS/State system performs approximately 69 percent of all publicly funded agricultural and forestry research in this country. Federal funds administered by CSRS serve as a catalyst, and leverage State and other non-Federal funds at a rate of 1 to 4. As a result of the Federal funds, the State partners bring all of their non-Federal funds to the planning table for a coordinated national program of agricultural research. The effect of Federal funds is therefore far greater than would be expected solely on the basis of the amount of funds provided. Let me give you a brief overview of the programs that CSRS administers.

In testifying today I want to emphasize that the Administration is currently formulating the President's FY 1994 Budget. Accordingly, I am not in a position to provide you with the Administration's position on funding for specific programs or activities, except for information previously published in the President's document "A Vision of Change for America." As soon as the President's FY 1994 Budget is released I would be pleased to provide you with the Department's views.

FORMULA BASED PROGRAMS

The State-Federal partnership in food and agricultural research and education has benefitted both American consumers and the agriculture industry and merits continued strong support. The Hatch, McIntire-Stennis Cooperative Forestry, Animal Health and Disease, and Evans-Allen formula based programs are the foundation upon which the remaining Federal funds build, including special and competitive research grants plus funds from the States and private industry. The Hatch Act authorizes research funds to the 59 State Agricultural Experiment Stations located in every State and seven Territories. Funding for research that provides knowledge essential to the efficient and effective use of the Nation's forestry resources is provided by the McIntire-Stennis Cooperative Forestry program. The Animal Health and Disease program authorizes funds to accredited schools or colleges of veterinary medicine or State Agricultural Experiment Stations to improve the health and productivity of animals and the welfare of producers and consumers of animal products. These three programs require the States to match Federal funds with non-Federal funds. Funding to the 1890 Colleges and Tuskegee University is provided through the Evans-Allen

program. This program is consistent with a broader USDA initiative to strengthen the contribution of the 1890 Institutions to agricultural and natural resources research and education. These four core programs support the basic laboratory facilities, scientists, and graduate students necessary for the long-term stability of agricultural research. In 1993, they comprise about $220 million or 51 percent of the $433 million CSRS research and education budget. These programs allow the institutions maximum flexibility to support research of the highest priority and at the same time assure the strong working relationship between the USDA and the State Agricultural Experiment Station system.

NATIONAL INITIATIVE FOR RESEARCH ON AGRICULTURE, FOOD AND ENVIRONMENT

In fiscal year 1991, a major new program was implemented by the Department of Agriculture -- the National Initiative for Research on Agriculture, Food and Environment (NRI) with an initial appropriation of $73 million. The Congress appropriated $97.5 million for the NRI each year in 1992 and 1993. We have been receiving the 1993 research proposals since early December and our last submission deadline is March 22.

The NRI has been broadly endorsed by users of research results and brings new Federal support for agricultural research awarded on a competitive basis. We are very pleased with the continued support received from the Congress on this major agricultural research initiative. In 1992, more than 2,900 proposals were submitted requesting about $597 million and we were able to support approximately 15 percent of the funds requested. During the past two years we provided to this Committee a monthly report summarizing the research objectives of each of the grants as they were awarded. A quarterly report was also

provided outlining the accomplishments of terminating competitive grants. We will continue to provide these reports to the Committee.

I want to stress that the NRI is truly a Departmentwide research initiative that happens to be located in CSRS. The responsibility for the policy and planning of the NRI lies with the Assistant Secretary of Science and Education and a Board of Directors who take into consideration the advice of the diverse individuals and groups interested in agricultural research. The Board, chaired by the Assistant Secretary, is composed of the Administrators of the Cooperative State Research Service, Agricultural Research Service, and Extension Service; the Director of the National Agricultural Library; the Chief Scientist of the NRI; the Forest Service Associate Chief for Research; and the Administrator of the Economic Research Service.

There are six research components in the NRI: natural resources and the environment; nutrition, food quality and health; plant systems including funds for the plant genome mapping program with the Agricultural Research Service as the lead agency; animal systems; markets, trade and rural development; and processes antecedent to adding value and developing new products. The NRI components have significant impact on programs in the Department's initiatives on water quality, global change, biofuels, food safety, biotechnology, human nutrition, new uses and products, and advanced materials.

The key to the NRI is its balanced approach focusing on priority issues using both fundamental science and the more applied research. It is from this balanced approach that major conceptual breakthroughs emerge. Fundamental research projects are both individual investigator grants and multidisciplinary

team research grants. Other forms of grants are directed at mission-linked studies, as well as institutional strengthening grants.

Funds are awarded through a competitive, science-based review process. This mechanism is well suited to stimulating new research activity in specific, high-priority areas of science and engineering. All public and private universities, research organizations, Federal agencies, private organizations or corporations, and individuals are eligible to compete for these funds. With increased growth in the NRI, USDA competitive research grants can be made more comparable in size and length to grants awarded by other Federal agencies.

The NRI has embarked on a mission to strengthen agricultural research at small and midsized institutions and institutions in States that have traditionally received less support from the competitive grants program--defined as USDA-EPSCoR (Experimental Program to Stimulate Competitive Research) States. A further goal was to encourage young talented scientists to pursue careers in agricultural research. In 1992 the NRI provided 186 grants amounting to almost $16.1 million through seed grants, equipment grants, new investigator grants, career enhancement awards, post doctoral grants and regular grant awards. Career enhancement awards are awarded to faculty wishing to enhance their research capabilities through sabbatical leaves.

Two programs in the new Markets, Trade and Policy Division, namely Rural Development and Markets, Competitiveness, and Technology Assessment, were implemented successfully in 1992. In addition, in response to a growing awareness of the need to enhance the competitive value and quality of U.S.

agricultural products, the NRI initiated a new program area in Processing for Adding Value or Developing New Products.

The NRI is strongly supported by the Administration as well as numerous producer and trade associations. Congress fully embraced the NRI in the 1990 Farm Bill. It has attracted the interest of the scientific community throughout the United States. The NRI is of critical importance to the future of American agriculture.

SPECIAL RESEARCH GRANTS AND OTHER GRANT PROGRAMS

The CSRS Special Research Grants program concentrates on problems of national and broad regional interest beyond the normal emphasis in the formula based programs. In 1993, $73.4 million is available. Important national needs are addressed such as integrated pest management/biological control, minor use animal drugs, the National Biological Impact Assessment program, pesticide clearance, pesticide impact assessment, water quality, and global change. The deadline for submission of 1993 water quality research proposals was December 21, 1992, and the 239 proposals received are now being reviewed.

The $6.7 million Sustainable Agriculture Research and Education or SARE program is designed to provide both a research and an education base for the future economic viability of U. S. agriculture. Special emphasis is placed on whole-farm systems research and economic impact assessment. SARE is managed through four regional administrative councils composed of farmers and ranchers, and representatives of non-profit private, agribusiness, government and academic organizations. Most funded projects have meaningful involvement of farmers or

ranchers. Sustainable agriculture farming practices enhance environmental quality and the natural resource base upon which the agriculture economy depends and make the most efficient use of non-renewable resources and integrate, where appropriate, natural biological cycles and controls.

The $4.0 million Aquaculture Regional Centers program supports five centers in the United States for research, development, demonstration, and education to enhance viable and profitable U. S. aquaculture which would benefit consumers, producers, service industries, and the American economy. With steadily increasing per capita consumption of seafood and a limited supply of wild stock, aquaculture will likely be a major growth industry in the 21st century. The Centers program focuses on priority R&D needs expressed by industry for improving aquaculture technology and market potential.

Research and development of industrial products and processes from crambe/rapeseed and guayule is currently being conducted under the CSRS Supplemental and Alternative Crops program at a level of $1.1 million. Crambe and rapeseed are annual oilseed sources of high erucic acid for high performance lubricants and polymers. In North Dakota, crambe production for industrial uses has gone from no commercial acreage in 1989 to 60,000 acres in production in 1993. Natural rubber from the perennial shrub guayule is undergoing qualification tests for Navy aircraft tires and in-service tire performance evaluation on Army trucks. An antifoulant biocide in guayule resin is under intensive R&D for marine paints and coatings.

The competitively awarded Rangeland Research program of $475,000 funds research on management, revegetation, and rehabilitation of rangelands.

In 1992, CSRS in cooperation with ARS implemented a new Biotechnology Risk Assessment Research Grants Program. The program funds competitively awarded grants to resolve risk assessment questions in support of biotechnology research and regulation. As required under section 1668 of the 1990 Farm Bill, one percent of biotechnology research funding is to be set-aside for this program. CSRS, ARS, and Forest Service contribute funds to the program. There was $1.4 million available in 1992 and the 1993 estimate is approximately $1.7 million.

HIGHER EDUCATION

Recognizing that education is the lever that can move this nation successfully into the 21st century, CSRS supports several mechanisms for advancing USDA's role in promoting excellence in education. We currently have a soundly integrated portfolio of programs which includes the National Needs Graduate Fellowships Program, the Institution Challenge Grants Program, the innovative Teaching and Research Capacity Building Grants Program for the 1890 Institutions, and the Morrill-Nelson program. These programs complement and build upon one another and are heartily endorsed by the Office of Science and Technology Policy - Federal Coordinating Council on Science, Engineering, and Technology - Committee on Education and Human Resources.

The $3.5 million National Needs Graduate Fellowships Program recruits and trains doctoral students in targeted shortage areas such as biotechnology, bioprocessing/engineering, food science/human nutrition, marketing, and water

science. Grants are awarded competitively to institutions identified via the science-based review process as offering excellent teaching and research programs in the targeted areas. This program was initiated in 1984 and has served to attract almost 700 superior new graduate students from a broad array of academic backgrounds into high priority disciplines. Evidence shows that without the fellowships program, most of these students would not be pursuing graduate study today in a food or agricultural discipline. We would likely have lost them to other areas of science and business.

The Institution Challenge Grants Program is designed to energize the educational system which is primarily responsible for training food and agricultural scientists and professionals. It stimulates the private sector to match, dollar for dollar, the Federal partner in providing support to strengthen the infrastructure of the U. S. food and agricultural sciences higher education system. This $1.5 million program fosters partnership ventures among universities, industry, and government. Areas of partnership initiatives include curricula revitalization, faculty development, innovative instruction delivery systems, and student experiential learning opportunities. Several of the projects supported will develop and deliver instruction via AG*SAT, the national satellite network developed by a consortium of 35 land-grant universities. Other projects will enhance agribusiness education, enrich programs of study through international experiences for students and faculty, and establish summer research programs for minority undergraduate students.

The 1890 Institution Capacity Building Grants Program serves as the crux of the Department's initiative to advance the teaching and research capacity of the 1890 Institutions and Tuskegee University. This competitively awarded program

strongly encourages matching funds from non-Federal sources and requires the institutions to cooperate with one or more USDA agencies in developing a proposal and in carrying out the capacity building project. This $10.25 million program is promoting partnership efforts with other institutions of higher education and private industry. The program is designed to encourage expanded linkages with 1890 Institutions as performers of research and developers of scientific and professional talent for the food and agricultural system.

The Morrill-Nelson program supports higher education in the food and agricultural sciences at land-grant institutions through a permanent appropriation of $50,000 per year to each State and Territory for a total program of $2.85 million. Many 1890 institutions benefit from these funds along with the 1862 land-grant institutions.

The investment we are making in these programs is having a tremendous impact on agriculture all across the Nation in terms of attracting outstanding young scholars, particularly women and minorities, broadening and updating the competencies of our faculties, and improving the overall quality of our curricula.

BUILDINGS AND FACILITIES

In 1993, $52.1 million was appropriated to CSRS for Buildings and Facilities at designated institutions. This program provides for the acquisition of land, construction, repair, improvement, extension, alteration, and purchase of fixed equipment or facilities to carry out agricultural research, extension, and teaching programs in the States.

REPORT OF SELECTED SIGNIFICANT ACCOMPLISHMENTS

Every year I like to report to this committee about some of the research being supported under the programs I have just discussed. Further, we are preparing a report reviewing the dynamics of the base program including many of the areas reported to you today.

Ground penetrating radar has been shown by researchers in New York and Wisconsin to be a new and effective tool in determining the routes that possible pollutants take on their way to the ground water. These studies show that layered soils have a substantial effect on how water and potential pollutants move through the media. The research, supported with Hatch Act funds, will assist in developing soil and crop management practices for those soils which make more efficient use of fertilizer and pesticides while still protecting the environment.

Iowa State University scientists have been working with an important pathogen of Southern corn leaf blight and have developed the most complete genetic map of any fungal plant pathogen to date. The detailed map of each chromosome of this fungus permits specific genetic manipulation to both determine and alter its aggressiveness on corn. This research, supported with Hatch Act funds, offers information useful to efficiently breed corn varieties that resist blighting and to attenuate the pathogenicity of the fungus.

Scientists at Florida A&M University have identified a protein marker in the peanut seed which will be useful to determine the maturity status of the seed.

In addition, factors affecting natural resistance of the peanut to aflatoxin contamination have been identified which would enable the industry to reduce aflatoxin contamination of peanut seed. This research was supported with Evans-Allen funds.

An Agricultural/Environmental Biotechnology Computer Bulletin Board, supported by the Special Research Grant for the National Biological Impact Assessment Program, is being operated by Virginia Polytechnic Institute and State University. The overall goal of the Bulletin Board is to expedite the flow of information on biotechnology to researchers in the field. This Bulletin Board combines a monthly News Report on current developments in agricultural/environmental biotechnology with direct access to 18 databases. The databases, which are continually revised and updated, range from full texts of all pertinent Federal regulations and guidelines to a registry of field tests conducted, current literature, State regulatory agencies, etc. Currently, there are 6,000 registered users of the Bulletin Board.

In research supported by the National Research Initiative at the University of California at Los Angeles, pima cotton lines were selected for higher yields and heat resistance. Physiological characterization showed the biological basis for these desirable traits. Leaves of desirable lines had higher evaporation rates and significantly cooler leaves, higher photosynthesis rates, and smaller leaf area than unimproved lines. Success in these studies should improve the ability to use such traits in breeding programs and enhance understanding of heat resistance.

NRI supported scientists at North Carolina State University have successfully produced a low density genome map of loblolly pine, the most economically important conifer in the United States. With this map it will be possible to identify desirable traits for breeding purposes.

Three of the goals of the Sustainable Agriculture Research and Education Program, also known as SARE, are to develop alternative systems of agriculture that are economically viable, environmentally sound and enhance the quality of life for farm families. During the past several years, new systems that combine rotations of corn, soybeans, small grains, and legumes have been tested and shown to significantly reduce and, in some cases, eliminate the need for herbicides in most growing seasons. These systems should be appropriate for crop agriculture in Iowa, Illinois, Indiana and Ohio, and possibly in other States. A second agricultural technology under extensive investigation by the SARE program has been shown to reduce environmental risks, increase profits and enhance farm family quality of life in animal agriculture. This system is called intensive rotational grazing, also known as controlled grazing management and short-duration grazing. The method is a simple system of controlling grazing by dividing pastures into small areas or paddocks that are grazed on a rotational basis, minimizing the waste of forage and protecting plants from overgrazing. It holds great promise for many types of animal agriculture, and has been successfully demonstrated in Vermont, Wisconsin, Tennessee and South Carolina. Both of these examples require extensive modern management technology uniquely integrated with the natural resource base of the farm.

New, high performance lubricants, engineering plastics, and processing aids are being commercialized using high erucic acid oils from industrial rapeseed and a

new crop, crambe. The new materials have their origins in research performed by the USDA's Agricultural Research Service and a number of private sector collaborators. Advanced lubricants, including transmission fluid treatments, gear oils and water dispersible, biodegradable cutting oils, are new commercial products resulting from collaboration between the private sector and the High Erucic Acid Development Effort, a consortium of universities, government laboratories and private companies that is managed by the CSRS Office of Agricultural Materials.

Mr. Chairman, that concludes my prepared remarks. I will be pleased to answer any questions.

COOPERATIVE STATE RESEARCH SERVICE

Purpose Statement

Cooperative State Research Service is the U.S. Department of Agriculture's principal entree to the university system of the United States for the purpose of conducting agricultural research and education programs as authorized by the Hatch Act of 1887, as amended (7 U.S.C. 361a-361i); the Cooperative Forestry Research Act of 1962, as amended (16 U.S.C. 582a-7); Public Law 89-106, Section (2), as amended (7 U.S.C. 450i); and the National Agricultural Research, Extension, and Teaching Policy Act of 1977, as amended (7 U.S.C. 3101 et seq.). Through these authorities, the U.S. Department of Agriculture participates with State and other sources of funding to encourage and assist the State institutions in the conduct of agricultural research and education through the State Agricultural Experiment Stations of the 50 States and the territories; by approved Schools of Forestry; the 1890 Land-Grant Institutions and Tuskegee University; Colleges of Veterinary Medicine; and other eligible institutions.

Cooperative State Research Service participates in a nationwide system of agricultural research and education program planning and coordination among the State institutions, U.S. Department of Agriculture and the agricultural industry of America. Program coordination and planning are carried out by a Cooperative State Research Service staff located entirely in the Washington, D.C. area. This headquarters unit serves more than 12,000 scientists in the university system of the United States. As of September 30, 1992, there were 203 full-time employees and 25 other than full-time employees.

COOPERATIVE STATE RESEARCH SERVICE

Available Funds and Staff-Years

1992 Actual and Estimated, 1993 and 1994

Item	1992 Actual Amount	1992 Staff-Years	1993 Estimated Amount	1993 Staff-Years	1994 Estimated Amount	1994 Staff-Years
Direct Appropriations:						
Cooperative State Research Service	432,712,000	198	432,993,000	211	431,407,000	251
Buildings and Facilities	74,770,000	10	52,101,000	10	- -	- -
Total, Direct Appropriations	507,482,000	208	485,094,000	221	431,407,000	251
Obligations under other USDA appropriations:						
Alternative Agricultural Research and Commercialization Center:						
Administrative Support	10,750	- - -	50,000	- - -	50,000	- -
Biobased Prods. Exec. Summary	- -	- - -	5,000	- - -	- -	- -
Technology 2000	- -	- - -	1,000	- - -	- -	- -
Agricultural Cooperative Service:						
Facilitator's Workshop	3,000	- - -	- -	- - -	- -	- -
Agricultural Research Service:						
Evaluation Studies	162,750	- - -	167,750	- - -	167,750	- -
Biotech. Risk Assessment	773,000	- - -	905,900	- - -	905,900	- -
Plant Foods & Bevs. in the Diet	17,500	- - -	- -	- - -	- -	- -
Water Quality Program	181,000	- - -	181,000	- - -	181,000	- -
Water Quality Project	- -	- - -	5,000	- - -	- -	- -
Office of Small Scale Agriculture	63,836	1	- -	- - -	- -	- -
Biotechnica Exhibition	1,130	- - -	- -	- - -	- -	- -
Biobased Industrial Products	12,500	- - -	- -	- - -	- -	- -
AFEX	10,850	- - -	- -	- - -	- -	- -
AMPP Crosscut Study	12,500	- - -	- -	- - -	- -	- -
Biobased Prods. Exec. Summary	- -	- - -	5,000	- - -	- -	- -
Research Apprenticeship Program	- -	- - -	250,000	- - -	250,000	- -
Agricultural Stabilization and Conservation Service:						
Demonstration & Instr. Farm Project	55,080	- - -	55,080	- - -	54,540	- -
Animal and Plant Health Inspection Service:						
Crown & Root Buds of Leafy Spurge	24,000	- - -	- -	- - -	- -	- -
Leafy Spurge Control	49,000	- - -	24,000	- - -	- -	- -
Bioeconomic Models for Leafy Spurge	48,600	- - -	48,600	- - -	- -	- -
Biotechnica Exhibition	1,080	- - -	- -	- - -	- -	- -
US-EC Biotechnology Workshop	5,000	- - -	- -	- - -	- -	- -
Office of Agricultural Biotechnology	- -	- - -	21,463	- - -	- -	- -
Euonymous Scale Control	- -	- - -	30,000	- - -	- -	- -
Biocontrol of Sweet Potato Whitefly	- -	- - -	25,000	- - -	- -	- -
Economic Management Staff:						
Special Programs	21,056	- - -	- -	- - -	- -	- -

Item	1992 Actual Amount	Staff-Years	1993 Estimated Amount	Staff-Years	1994 Estimated Amount	Staff-Years
Economic Research Service:						
Biobased Industrial Products	5,000	- -	- -	- -	- -	- -
Extension Service:						
Rural Development Centers	2,000	- -	- -	- -	- -	- -
Biotechnica Exhibition	1,130	- -	- -	- -	- -	- -
Federal Grain Inspection Service:						
Research Science Program	77,760	- -	- -	- -	- -	- -
Food Safety and Inspection Service:						
Symposium for Public Voice	10,800	- -	10,800	- -	10,800	- -
Veterinary Products Info. System	40,000	- -	40,000	- -	40,000	- -
Animal Biotechnology Conference	5,400	- -	- -	- -	- -	- -
Office of Agricultural Biotechnology	- -	- -	23,000	- -	- -	- -
Beef Study	- -	- -	108,000	- -	- -	- -
E. Coli Study	- -	- -	40,000	- -	- -	- -
Forest Service:						
Biotech. Risk Assessment	43,000	- -	62,000	- -	85,000	- -
Forestry Research	8,590	- -	- -	- -	- -	- -
Atmospheric Deposition	111,145	- -	137,996	- -	137,996	- -
International Chestnut Symposium	8,100	- -	- -	- -	- -	- -
AMPP Crosscut Study	1,000	- -	- -	- -	- -	- -
Biobased Industrial Products	12,500	- -	- -	- -	- -	- -
National Agricultural Library:						
Information Services	2,529	- -	2,529	- -	2,529	- -
Biotechnica Exhibition	1,130	- -	- -	- -	- -	- -
Office of Energy:						
Biobased Industrial Products	12,500	- -	- -	- -	- -	- -
AFEX	3,000	- -	- -	- -	- -	- -
Various agencies sharing cost of USDA Small Business Innovation Research Program (SBIR)	592,675	- -	1,049,456	- -	1,170,633	- -
Various research agencies sharing cost of Current Research Information System (CRIS)	761,200	9	761,200	9	761,200	9
Other Anticipated Reimbursements	- -	- -	24,318	- -	223,235	- -
Total, Other USDA Appropriations	3,152,091	10	4,034,092	9	4,040,583	9
Total Agriculture Appropriations	510,634,091	218	489,128,092	230	435,447,583	260
Other Federal Funds:						
Army Corps of Engineers:						
Computerized Environmental Resources	120,000	- -	174,761	- -	- -	- -
Regional Recreation Demand Models	150,000	- -	150,000	- -	150,000	- -
Economic Impact Models	92,880	- -	- -	- -	- -	- -
Waterway Network Research	65,750	- -	42,392	- -	- -	- -
Economic Valuation of Wetlands	27,000	- -	27,000	- -	- -	- -
Ecological Functions of Wetlands	193,024	- -	- -	- -	- -	- -
Functional Level of Created Marshes	95,844	- -	- -	- -	- -	- -
Local Public Finance Impact Model	70,000	- -	70,000	- -	70,000	- -
User Fees Study	- -	- -	32,400	- -	- -	- -
Outdoor Recreation Opportunities	- -	- -	38,837	- -	58,050	- -
Moist Soil Management	- -	- -	26,465	- -	25,532	- -

Item	1992 Actual Amount	1992 Staff-Years	1993 Estimated Amount	1993 Staff-Years	1994 Estimated Amount	1994 Staff-Years
Department of Commerce, NOAA,						
Atmospheric Deposition	80,002	- -	200,260	- -	200,260	- -
Department of Defense:						
Biodegradable Plastics Research	2,365,000	- -	2,000,000	- -	- -	- -
Department of Interior:						
Bureau of Land Management,						
Atmospheric Deposition	88,328	- -	63,000	- -	63,000	- -
Incentive-Based Grazing Fee	74,854	- -	229,905	- -	- -	- -
Geological Survey, Atmospheric Deposition	499,081	- -	482,518	- -	482,518	- -
National Park Service, Atmospheric Deposition	102,064	- -	124,225	- -	124,225	- -
Environmental Protection Agency:						
Atmospheric Deposition	38,637	- -	53,640	- -	53,640	- -
US-EC Biotechnology Workshop	10,000	- -	- -	- -	- -	- -
Nitrogen Testing for Water Quality	30,000	- -	- -	- -	- -	- -
Sust. Farming Practices Demon.	1,000	- -	- -	- -	- -	- -
Agric. in Concert with Environment	1,000,000	- -	900,000	- -	1,000,000	- -
Sustainable Agric. Demonstration	15,000	- -	- -	- -	- -	- -
Sewage Sluge on Land	- -	- -	800,000	- -	- -	- -
Food and Drug Administration:						
Veterinary Products Info. System	54,000	- -	54,000	- -	- -	- -
US-EC Biotechnology Workshop	4,000	- -	- -	- -	- -	- -
General Accounting Office:						
Wheat Marketing Export	- -	- -	25,920	- -	- -	- -
National Marine Fisheries Services:						
Hatchery-Reared Oysters	10,000	- -	- -	- -	- -	- -
National Science Foundation:						
US-EC Biotechnology Workshop	10,000	- -	- -	- -	- -	- -
Naval Medical Research Institute:						
Enteric Diseases Program	67,583	- -	- -	- -	- -	- -
Office of Naval Research:						
US-EC Biotechnology Workshop	10,000	- -	- -	- -	- -	- -
Office of Science & Technology Policy:						
Scientific Services	- -	- -	24,075	- -	- -	- -
Tennessee Valley Authority,						
Atmospheric Deposition	17,279	- -	22,192	- -	22,192	- -
Other Anticipated Reimbursements	- -	- -	24,318	- -	3,310,000	- -
Total, Other Federal Funds	5,291,326	- -	5,565,908	- -	5,559,417	- -
Total, Cooperative State Research Service	515,925,417	218	494,694,000	230	441,007,000	260

COOPERATIVE STATE RESEARCH SERVICE

Permanent Positions by Grade and Staff-Year Summary

1992 and Estimated 1993 and 1994

Grade	1992 Headquarters	1993 Headquarters	1994 Headquarters
ES-6	1	1	1
ES-5	2	2	2
ES-4	2	3	3
Senior Level	4	4	4
GS/GM-15	39	40	41
GS/GM-14	21	21	23
GS/GM-13	14	15	22
GS-12	21	22	24
GS-11	14	15	17
GS-10	2	2	2
GS-9	18	19	23
GS-8	4	4	4
GS-7	24	26	31
GS-6	28	30	36
GS-5	19	19	20
GS-4	11	11	11
GS-3	1	1	1
Total Permanent Positions	225	235	265
Unfilled Positions end-of-year . . .	-21	-10	-10
Total, Permanent Employment, end-of-year	204	225	255
Staff-Years: Ceiling	218	230	260

COOPERATIVE STATE RESEARCH SERVICE

CLASSIFICATION BY OBJECTS

1992 and Estimated 1993 and 1994

	1992	1993	1994
Personnel Compensation:			
Headquarters	$9,123,318	$9,876,000	$10,189,000
Field	- -	- -	- -
11 Total Personnel Compensation...........	9,123,318	9,876,000	10,189,000
12 Personnel Benefits	1,566,719	1,695,000	1,749,000
13 Benefits for former personnel	5,758	6,000	6,000
Total Pers. Comp. & Benefits .	10,695,795	11,577,000	11,944,000
Other Objects:			
21 Travel	1,540,165	1,590,000	1,590,000
22 Transportation of things	67,506	69,000	65,000
23.3 Communications, utilities & miscellaneous charges	813,309	818,000	781,000
24 Printing and reproduction.	305,757	309,000	309,000
25.1 Consulting..............	202,650	203,000	277,000
25.2 Other services	3,849,382	3,187,129	702,999
26 Supplies and materials ...	289,371	299,000	286,000
31 Equipment	355,479	405,000	389,000
41 Grants, subsidies and contributions	477,453,808	483,608,871	415,063,001
Total other objects..........	484,877,427	490,489,000	419,463,000
Total direct obligations	495,573,222	502,066,000	431,407,000
Position Data:			
Average Salary, ES positions	$107,340	$110,209	$110,209
Average Salary, SL positions	$93,150	$96,131	$96,131
Average Salary, GM/GS positions	$41,462	$42,453	$41,394
Average Grade, GM/GS positions	10.00	9.98	9.93

COOPERATIVE STATE RESEARCH SERVICE

The estimates include proposed changes in the language of this item as follows (new language underscored; deleted matter enclosed in brackets):

Cooperative State Research Service:

For payments to agricultural experiment stations, for cooperative forestry
and other research, for facilities, and for other expenses, including
[$168,785,000] $173,451,000 to carry into effect the provisions of the
Hatch Act approved March 2, 1887, as amended, including administration by
the United States Department of Agriculture, penalty mail costs of
agricultural experiment stations under section 6 of the Hatch Act of 1887,
as amended, and payments under section 1361(c) of the Act of October 3,
1980 (7 U.S.C. 301n.); [$18,533,000] $19,045,000 for grants for cooperative
forestry research under the Act approved October 10, 1962 (16 U.S.C.
582a-582-a7), as amended, including administrative expenses, and payments
under section 1361(c) of the Act of October 3, 1980 (7 U.S.C. 301n.);
[$27,400,000] $28,157,000 for payments to the 1890 land-grant colleges,
including Tuskegee University, for research under section 1445 of the
National Agricultural Research, Extension, and Teaching Policy Act of 1977
(7 U.S.C. 3222), as amended, including administration by the United States
Department of Agriculture, and penalty mail costs of the 1890 land-grant
colleges, including Tuskegee University; [$73,411,000] $34,418,000 for
1 [contracts and] special grants for agricultural research under section 2(c)
of the Act of August 4, 1965, as amended (7 U.S.C. 450i[);](c)), including
administrative expenses; [$97,500,000] $100,195,000 for competitive
research grants under section 2(b) of the Act of August 4, 1965, as amended
2 (7 U.S.C. 450i(b)), including administrative expenses; [$5,551,000 for the
support of animal health and disease programs authorized by section 1433 of
Public Law 95-113, including administrative expenses; $1,168,000]
$3,000,000 for supplemental and alternative crops and products as
authorized by the National Agricultural Research, Extension, and Teaching
3 Policy Act of 1977 (7 U.S.C. 3319d); [$400,000 for grants for research
pursuant to the Critical Agricultural Materials Act of 1984 (7 U.S.C. 178)
and section 1472 of the Food and Agriculture Act of 1977, as amended (7
U.S.C. 3318), to remain available until expended; $475,000] $489,000 for
rangeland research grants as authorized by subtitle M of the National
Agricultural Research, Extension, and Teaching Policy Act of 1977, as
amended; [$3,500,000] $3,597,000 for higher education graduate fellowships
grants under section 1417(b)(6) of the National Agricultural Research,
Extension, and Teaching Policy Act of 1977, as amended (7 U.S.C.
3152(b)(6)), including administrative expenses; [$1,500,000] $1,542,000 for
higher education challenge grants under section 1417(b)(1) of the National
Agricultural Research, Extension, and Teaching Policy Act of 1977, as
amended (7 U.S.C. 3152(b)(1)), including administrative expenses;
4 $1,000,000 for a higher education minority scholars program under section
1417(b)(2) of the National Agricultural Research, Extension, and Teaching
Policy Act of 1977, as amended (7 U.S.C. 3152(b)(2)), including
administrative expenses; [$4,000,000] $4,111,000 for grants as authorized
by section 1475 of the National Agricultural Research, Extension, and
Teaching Policy Act of 1977 and other Acts; [$6,725,000] $6,911,000 for
sustainable agriculture research and education, as authorized by section
1621 of Public Law 101-624 (7 U.S.C. 5811), including administrative
5 expenses; [$400,000 for State agricultural weather information systems
pursuant to section 1640 of the Food, Agriculture, Conservation, and Trade
Act of 1990 (7 U.S.C. 3318);] and [$20,795,000] $13,641,000 for necessary
expenses of Cooperative State Research Service activities, including
coordination and program leadership for higher education work of the

Department, administration of payments to State agricultural experiment stations, funds for employment pursuant to the second sentence of section 706(a) of the Organic Act of 1944 (7 U.S.C. 2225), of which [$10,250,000] $11,500,000 shall be for a program of capacity building grants to colleges eligible to receive funds under the Act of August 30, 1890 (7 U.S.C. 321-326 and 328), including Tuskegee University, of which not to exceed $100,000 shall be for employment under 5 U.S.C. 3109; in all, [$430,143,000] $389,557,000.

The first change revises the language to make specific reference to special grants, consistent with the amendment to this authority in the Food, Agriculture, Conservation, and Trade Act of 1990; adds language to provide for administrative expenses; and clarifies the U.S. Code citation.

The second change deletes language for the animal health and disease research program. No funding is proposed for this program in fiscal year 1994.

The third change deletes language for research pursuant to the Critical Agricultural Materials Act of 1984. No funding is proposed for this program in fiscal year 1994.

The fourth change adds language for a higher education minority scholars program.

The fifth change deletes language for State agricultural weather information systems. No funding is proposed for this program in fiscal year 1994.

COOPERATIVE STATE RESEARCH SERVICE

Appropriations Act, 1993	$430,143,000
Morrill-Nelson	2,850,000
Total, Appropriations Act, 1993	432,993,000
Budget Estimate, 1994	392,407,000
Decrease in Appropriations	-40,586,000

SUMMARY OF INCREASES AND DECREASES

Item of Change	1993 Estimated	Pay Cost	Other Changes	1994 Estimated
Payments under the Hatch Act ...	$168,785,000	- -	+$4,666,000	$173,451,000
Cooperative forestry research ..	18,533,000	- -	+512,000	19,045,000
Payments to 1890 colleges and Tuskegee University	27,400,000	- -	+757,000	28,157,000
Special research grants	86,579,000	- -	-37,650,000	48,929,000
National Research Initiative competitive grants	97,500,000	- -	+2,695,000	100,195,000
Animal health and disease research, Section 1433	5,551,000	- -	-5,551,000	- -
Federal administration (direct appropriation)	20,795,000	+367,000	-7,521,000	13,641,000
Higher education:				
Morrill-Nelson	2,850,000	- -	- -	2,850,000
Other	5,000,000	- -	+1,139,000	6,139,000
Total Available	432,993,000	+367,000	-40,953,000	392,407,000
Recap:				
Direct appropriations	430,143,000	+367,000	-40,953,000	389,557,000
Permanent appropriations	2,850,000	- -	- -	2,850,000
TOTAL	432,993,000	+367,000	-40,953,000	392,407,000

PROJECT STATEMENT
(On basis of appropriation)

Project	1992 Actual Amount	Staff Years	1993 Estimated Amount	Staff Years	Increase or Decrease	1994 Estimated Amount	Staff Years
1. Hatch Act							
Research program:							
Formula funds	$124,306,970		$124,474,748		+$3,359,520	$127,834,268	
Regional research.	39,482,313		39,482,313		+1,166,500	40,648,813	
Subtotal	163,789,283		163,957,061		+4,526,020	168,483,081	
Federal Admin. (3%)	4,827,939		4,827,939		+139,980	4,967,919	
Total	168,617,222	60	168,785,000	60	+4,666,000 (1)	173,451,000	69
2. Cooperative Forestry Research:							
Research program ..	17,977,010		17,977,010		+496,640	18,473,650	
Federal Admin. (3%)	555,990		555,990		+15,360	571,350	
Total	18,533,000	6	18,533,000	6	+512,000 (2)	19,045,000	7
3. Payments to 1890 Colleges & Tuskegee University:							
Research program ..	26,578,000		26,578,000		+734,290	27,312,290	
Federal Admin. (3%)	822,000		822,000		+22,710	844,710	
Total	27,400,000	10	27,400,000	10	+757,000 (3)	28,157,000	11
4. Special Research Grants:							
Aflatoxin research, Illinois	134,000		134,000		-134,000	- -	
Agribusiness management, Mississippi ..	75,000		75,000		-75,000	- -	
Agricultural diversification, Hawaii ..	154,000		154,000		-154,000	- -	
Agricultural management systems, MA ..	261,000		261,000		-261,000	- -	
Agricultural Processing, Georgia	- -		50,000		-50,000	- -	
Agricultural trade, North Dakota	350,000		350,000		-350,000	- -	
Alfalfa research, KS	125,000		125,000		-125,000	- -	
Alternative cropping systems in the Southeast, S.Carolina .	278,000		278,000		-278,000	- -	
Alternative crops, North Dakota	700,000		700,000		-700,000	- -	
Alternative marine & fresh water species, Mississippi	275,000		275,000		-275,000	- -	
Alternative pest control, Arkansas .	1,400,000		1,400,000		-1,400,000	- -	
Alternative to Dinoseb, Oregon ...	225,000		225,000		-225,000	- -	
Animal Science Food Safety Consortium .	1,942,000		1,942,000		-1,942,000	- -	
Animal waste disposal, Michigan ...	120,000		120,000		-120,000	- -	
Appalachian hardwoods, West Virginia	(a)		- -		- -	- -	
Apple quality research, Michigan ..	94,000		94,000		-94,000	- -	
Aquaculture research (general)	316,000		316,000		-316,000	- -	
Aquaculture, Illinois	200,000		200,000		-200,000	- -	
Aquaculture, LA	390,000		390,000		-390,000	- -	

Project	1992 Actual Amount	1992 Actual Staff-Years	1993 Estimated Amount	1993 Estimated Staff-Years	Increase or Decrease	1994 Estimated Amount	1994 Estimated Staff-Years
Aquaculture, Stoneville, Mississippi.	$700,000		$700,000		-$700,000	- -	
Asparagus yield decline, Michigan .	94,000		94,000		-94,000	- -	
Babcoc Institute, WI	75,000		75,000		-75,000		
Bean and beet research, Michigan ..	189,000		189,000		-189,000	- -	
Beef carcass evaluation and identification	210,000		210,000		-210,000	- -	
Beef fat content, IA	237,000		237,000		-237,000	- -	
Biodiesel research, MO	- -		50,000		-50,000	- -	
Broom snakeweed, NM	200,000		200,000		-200,000	- -	
Canola research, KS	100,000		100,000		-100,000	- -	
Celery fusarium, MI	39,000		39,000		-39,000	- -	
Center for animal health and productivity, PA	- -		134,000		-134,000	- -	
Center for rural studies, Vermont ..	37,000		37,000		-37,000	- -	
Chesapeake Bay aquaculture, Maryland .	437,000		437,000		-437,000	- -	
Competitiveness of agriculture products, Washington ..	800,000		800,000		-800,000	- -	
CONSOIL, Wisconsin .	25,000		75,000		-75,000	- -	
Controlled environmental production systems, PA	240,000		240,000		-240,000	- -	
Cool season legume research	387,000		387,000		-387,000	- -	
Cottonseed extraction and oil refining, TX	75,000		75,000		-75,000	- -	
Cranberry/blueberry disease & breeding, New Jersey	260,000		260,000		-260,000	- -	
CRP acreage usage, Missouri	50,000		- -		- -	- -	
Dairy goat research, Prairie View A&M, Texas	75,000		75,000		-75,000	- -	
Delta rural revitalization, Mississippi	175,000		175,000		-175,000	- -	
Dogwood anthracnose, Georgia, N. Carolina and Tennessee	137,000		137,000		-137,000	- -	
Dried bean research, North Dakota	100,000		100,000		-100,000	- -	
Eastern filbert blight, Oregon	85,000		85,000		-85,000	- -	
Energy biomass/ biofuels	- -		- -		+1,000,000	$1,000,000	
Enhanced livestock production, ND	250,000		- -		- -	- -	
Environmental research, New York ..	575,000		575,000		-575,000	- -	
Ethanol research, AR	175,000		- -		- -	- -	
Expanded wheat pasture, Oklahoma .	337,000		337,000		-337,000	- -	
Export development, Kentucky	227,000		227,000		-227,000	- -	
Farm and rural business finance, Illinois and Arkansas .	125,000		125,000		-125,000	- -	
Farm computer technology, Georgia ...	- -		100,000		-100,000	- -	
Fish marketing, Oregon and RI	340,000		340,000		-340,000	- -	

Project	1992 Actual Amount	1992 Staff-Years	1993 Estimated Amount	1993 Staff-Years	Increase or Decrease	1994 Estimated Amount	1994 Staff Years
Floriculture, Hawaii	$296,000		$296,000		-$296,000	- -	
Food & Agriculture Policy Institute, Iowa & Missouri ...	750,000		750,000		-750,000	- -	
Food irradiation, IA	237,000		237,000		-237,000	- -	
Food Marketing Policy Center, Connecticut	393,000		393,000		-393,000	- -	
Food processing center, Nebraska ..	50,000		50,000		-50,000	- -	
Food systems group, Wisconsin	261,000		261,000		-261,000	- -	
Forestry marketing, VT and NH	50,000		50,000		-50,000	- -	
Genetic engineering of plants, Ohio ...	240,000		- -		- -	- -	
Global change	2,000,000		2,000,000		+1,000,000	$3,000,000	
Grasshopper biocontrol, North Dakota.	75,000		75,000		-75,000	- -	
Great Plains Agriculture Policy Center, KS and OK .	100,000		100,000		-100,000	- -	
Human nutrition, Iowa	500,000		500,000		-500,000	- -	
Human nutrition, LA.	800,000		800,000		-800,000	- -	
Human nutrition, NY.	735,000		735,000		-735,000	- -	
Improved dairy management, PA	335,000		335,000		-335,000	- -	
Integrated orchard management, Vermont	(a)		- -		- -	- -	
Integrated pest management and biological control	4,457,000		4,457,000		+2,543,000	7,000,000	
Integrated production systems, OK ..	193,000		190,000		-190,000	- -	
International livestock program, KS .	94,000		- -		- -	- -	
Iowa Biotechnology Consortium	1,953,000		2,000,000		-2,000,000	- -	
Irrigation/fish production, Arkansas .	167,000		- -		- -	- -	
Kansas facility study	50,000		- -		- -	- -	
Leafy spurge biocontrol, Montana ..	125,000		- -		- -	- -	
Livestock & dairy policy, New York & Texas	525,000		525,000		-525,000	- -	
Lowbush blueberry research, Maine ...	185,000		185,000		-185,000	- -	
Low-input agric., MN	230,000		230,000		-230,000	- -	
Maple research, VT .	99,000		99,000		-99,000	- -	
Massachusetts Biotechnology	- -		256,000		-256,000	- -	
Mechanical tomato harvester, PA	134,000		- -		- -	- -	
Mesquite and prickly pear, Texas	100,000		- -		- -	- -	
Michigan Biotechnology Institute ...	2,358,000		2,358,000		-2,358,000	- -	
Midwest agricultural products, Iowa	700,000		700,000		-700,000	- -	
Midwest Biotechnology Consortium	2,865,000		2,865,000		-2,865,000	- -	
Milk safety, PA	284,000		184,000		-184,000	- -	
Milkweed research, Nebraska	80,000		- -		- -	- -	
Mink research, Oregon	46,000		- -		- -	- -	

Project	1992 Actual Amount	1992 Actual Staff Years	1993 Estimated Amount	1993 Estimated Staff Years	Increase or Decrease	1994 Estimated Amount	1994 Estimated Staff Years
Minor crop pest control, Hawaii ...	$285,000		$285,000		-$285,000	- -	
Minor use animal drugs	464,000		464,000		+186,000	$650,000	
Mosquito research, riceland agro-ecosystem	453,000		- -		- -	- -	
Multi-commodity research, OR	- -		300,000		-300,000	- -	
Multi-cropping strategies for aquaculture, Hawaii ...	150,000		150,000		-150,000	- -	
National Biological Impact Assessment Program	300,000		300,000		- -	300,000	
Nematode resistance genetic engineering, New Mexico	150,000		150,000		-150,000	- -	
New uses for agricultural products, Ohio	140,000		140,000		-140,000	- -	
Nonfood agricultural products, Nebraska.	110,000		110,000		-110,000	- -	
Oil from jojoba, NM	200,000		200,000		-200,000	- -	
Oregon/Massachusetts biotechnology	537,000		- -		- -	- -	
Peach tree short life, South Carolina	192,000		192,000		-192,000	- -	
Perishable commodities, Georgia	- -		250,000		-250,000	- -	
Pest control alternatives	125,000		125,000		-125,000	- -	
Pesticide clearance.	3,500,000		3,500,000		+6,500,000	10,000,000	
Pesticide impact assessment	2,968,000		2,968,000		- -	2,968,000	
Pesticide research, Washington	667,000		667,000		-667,000	- -	
Phytophthora root rot, New Mexico ...	150,000		150,000		-150,000	- -	
Potato research	1,435,000		1,435,000		-1,435,000	- -	
Potato utilization, ND	- -		250,000		-250,000	- -	
Poultry research, GA	172,000		516,000		-516,000	- -	
Preservation and processing, Oklahoma .	282,000		267,000		-267,000	- -	
Procerum root disease, Vermont	25,000		25,000		-25,000	- -	
Product development and marketing center, Maine	221,000		221,000		-221,000	- -	
Red River Corridor, MN & ND	200,000		200,000		-200,000	- -	
Regional barley gene mapping project ...	412,000		412,000		-412,000	- -	
Regionalized implications of farm programs, Missouri and Texas	348,000		348,000		-348,000	- -	
Rural development centers	500,000		500,000		- -	500,000	
Rural economic development, Georgia ...	744,000		- -		- -	- -	
Rural environmental research, Illinois.	125,000		125,000		-125,000	- -	
Rural housing needs, NE	- -		80,000		-80,000	- -	
Rural policies institute, Arkansas, Nebraska, Missouri	525,000		692,000		-692,000	- -	
Russian wheat aphid.	437,000		437,000		-437,000	- -	
Safflower research, N. Dakota & Montana	250,000		250,000		-250,000	- -	
Sandhills grazing management practices Nebraska	99,000		- -		- -	- -	

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Project	1992 Actual Amount	Staff-Years	1993 Estimated Amount	Staff-Years	Increase or Decrease	1994 Estimated Amount	Staff-Years
Seafood and aquaculture harvesting, processing, marketing, Mississippi ..	$361,000		$361,000		-$361,000	- -	
Seafood research, OR	- -		327,000		-327,000	- -	
Seedless table grapes, Arkansas	(a)		- -		- -	- -	
Small fruit research, Oregon, Washington, Idaho	187,000		187,000		-187,000	- -	
Soil and water research, Ohio	- -		240,000		-240,000	- -	
Southwest consortium for plant genetics & water resources ...	400,000		400,000		-400,000	- -	
Soybean bioprocessing, Iowa	275,000		328,000		-328,000	- -	
Soybean cyst nematode, Missouri	359,000		359,000		-359,000	- -	
STEEP II - Water quality in Pacific Northwest	980,000		980,000		-980,000	- -	
Stone fruit decline, Michigan	283,000		283,000		-283,000	- -	
Subirrigation research, Michigan ..	531,000		531,000		-531,000	- -	
Sunflower insects, North Dakota and South Dakota	200,000		200,000		-200,000	- -	
Sustainable agriculture and natural resources, PA	- -		100,000		-100,000	- -	
Sustainable agriculture systems, NE	70,000		70,000		-70,000	- -	
Swine research, MN .	140,000		140,000		-140,000	- -	
TCK smut (wheat) ...	250,000		250,000		-250,000	- -	
Technology transfer development, Iowa .	100,000		- -		- -	- -	
Tropical & subtropical research .	3,320,000		3,320,000		-3,320,000	- -	
Urban pests, Georgia	76,000		76,000		-76,000	- -	
Water conservation, KS	- -		94,000		-94,000	- -	
Water conservation, Nevada	200,000		200,000		-200,000	- -	
Water management, AL	398,000		398,000		-398,000	- -	
Water quality	9,000,000		8,950,000		+50,000	$9,000,000	
Weed control, ND ...	500,000		500,000		-500,000	- -	
Wheat genetics, KS .	159,000		159,000		-159,000	- -	
Wheat marketing, OR	300,000		- -		- -	- -	
White mold research, Ohio	55,000		55,000		-55,000	- -	
Wild rice research, Minnesota	88,000		88,000		-88,000	- -	
Wood utilization ...	2,852,000		4,153,000		-4,153,000	- -	
Wool research	250,000		250,000		-250,000	- -	
World food systems, Indiana and Ohio ..	368,000		368,000		-368,000	- -	
Federal Admin. (4%).	(2,925,200)		(2,936,440)		(-1,559,720)	(1,376,720)	
Total	73,130,000		73,411,000		-38,993,000	34,418,000	
Critical Agricultural Materials Act of 1984							
Research program ..	388,000		388,000		-388,000	- -	
Federal Admin. (3%)	12,000		12,000		-12,000	- -	
Total	400,000		400,000		-400,000	- -	
Rangeland Research Grants (Subtitle M):							
Research program ..	460,750		460,750		+13,580	474,330	
Federal Admin. (3%)	14,250		14,250		+420	14,670	
Total	475,000		475,000		+14,000	489,000	

Project	1992 Actual Amount	1992 Staff-Years	1993 Estimated Amount	1993 Staff-Years	Increase or Decrease	1994 Estimated Amount	1994 Staff Years
Aquaculture Centers, Section 1475:							
Research program ..	$3,880,000		$3,880,000		+$107,670	$3,987,670	
Federal Admin. (3%)	120,000		120,000		+3,330	123,330	
Total	4,000,000		4,000,000		+111,000	4,111,000	
Sustainable Agric. Program	6,523,250		6,523,250		+180,420	6,703,670	
Federal Admin. (3%)	201,750		201,750		+5,580	207,330	
Total	6,725,000		6,725,000		+186,000	6,911,000	
Supplemental and Alternative Crops, Sec. 1473D:							
Crambe/Rapeseed ...	500,000		500,000		-500,000	- -	
Guayule research ..	668,000		668,000		-668,000	- -	
Advanced Materials.	- -		- -		+3,000,000	3,000,000	
Federal Admin. (3%)	(35,040)		(35,040)		(+54,960)	(90,000)	
Total	1,168,000		1,168,000		+1,832,000	3,000,000	
State Agricultural Weather Information System, Sec. 1640 .	388,000		388,000		-388,000	- -	
Federal Admin. (3%)	12,000		12,000		-12,000	- -	
Total	400,000		400,000		-400,000	- -	
	86,298,000	35	86,579,000	37	-37,650,000 (4)	48,929,000	37
5.National Research Initiative Competitive Grants (NRI):							
Natural Resources and Environment ...	18,000,000		18,000,000		- -	18,000,000	
Nutrition, Food Quality, & Health .	6,500,000		6,500,000		- -	6,500,000	
Plant Systems	40,000,000		40,000,000		+2,695,000	42,695,000	
Animal Systems	25,000,000		25,000,000		- -	25,000,000	
Processing for value-added products	4,000,000		4,000,000		- -	4,000,000	
Rural development, markets, and trade (b)	4,000,000		4,000,000		- -	4,000,000	
Federal Admin. (4%).	(3,900,000)		(3,900,000)		(+107,800)	(4,007,800)	
Total	97,500,000	59	97,500,000	72	+2,695,000 (5)	100,195,000	72
6.Animal Health and Disease Research, Section 1433:							
Research program ...	5,328,960		5,328,960		-5,328,960	- -	
Federal Admin. (4%).	222,040		222,040		-222,040	- -	
Total	5,551,000	2	5,551,000	2	-5,551,000 (6)	- -	- -
7.Federal Administration (Direct App.) (c)							
Gulf Coast shri- .. aquaculture	3,500,000		3,500,000		-3,500,000	- -	
Mississippi Valley State University ..	668,000		668,000		-668,000	- -	
Iowa State-Center for Ag. & Rural Dev. ..	750,000		750,000		-750,000	- -	
Geographic Information System Pilot Program	1,000,000		1,000,000		-1,000,000	- -	
Vocational Agriculture Curriculum, Aquaculture	500,000		500,000		-500,000	- -	
Maize Genetics Research Center, Univ. of North Dakota ...	400,000		400,000		-400,000	- -	

Project	1992 Actual Amount	Staff Years	1993 Estimated Amount	Staff Years	Increase or Decrease	1994 Estimated Amount	Staff Years
Herd Management Prog. Tennessee State Univ	$475,000		$475,000		-$475,000	- -	
Alternative Fuels Characterization Lab University of MD ..	250,000		250,000		-250,000	- -	
Water Quality, So. Illinois University	750,000		750,000		-750,000	- -	
Water Quality, Univ. of North Dakota ...	500,000		500,000		-500,000	- -	
Office of Grants and Program Systems ...	334,000		334,000		-226,000	$108,000	
Office of Agricultural Biotechnology	400,000		400,000		- -	400,000	
Ag in the Classroom.	208,000		208,000		+8,000	216,000	
Peer Panels	260,000		260,000		+240,000	500,000	
Previous Year Pay Costs	550,000		550,000		- -	550,000	
New Pay Costs	- -		- -		+367,000	367,000	
1890 Capacity Building Grants ...	10,250,000		10,250,000		+1,250,000	11,500,000	
Total	20,795,000	18	20,795,000	16	-7,154,000 (7)	13,641,000	16
8.Higher Education:							
Graduate Fellowships Grants	3,500,000		3,500,000		+97,000	3,597,000	
Institution Challenge Grants	1,500,000		1,500,000		+42,000	1,542,000	
Morrill-Nelson Funds (Permanent Appro.).	2,850,000		2,850,000		- -	2,850,000	
Minority Scholars Program	- -		- -		+1,000,000	1,000,000	
Federal Admin. (3%)	(150,000)		(150,000)		(+34,170)	(184,170)	
Total	7,850,000	8	7,850,000	8	+1,139,000 (8)	8,989,000	9
Total, Obligations	432,544,222	198	432,993,000	211	-40,586,000	392,407,000	221
Unobligated balance ...	+167,778		- -				
Total, Appropriation ..	432,712,000	198	432,993,000	211			
Investment Proposals ..						39,000,000	30
Total, President's Budget						431,407,000	251

(a) Funds were rescinded for three Special Research Grants totaling $849,000 per P.L. 102-298.

(b) Name changed from Markets, Trade, and Policy in 1994.

(c) The amounts listed in this table do not include all the costs associated with the items within the Direct Federal Administration activity. The amounts listed below are the additional costs that are funded for these purposes from the administrative set-aside of program funds.

Project	1992 Actual	1993 Estimated	1994 Estimated
Ag in the Classroom	$2,671	0	0
Office of Agricultural Biotechnology	230,944	$223,526	$229,761
Peer Panels	778,792	790,000	700,000
Office of Grants and Program Systems	5,756,494	6,636,110	6,764,453
Other, Federal Administration	6,768,901	7,649,636	7,694,214

EXPLANATION OF PROGRAM

The funds appropriated for the Cooperative State Research Service (CSRS) provide the Federal Government's support for research and education programs at land-grant agricultural experiment stations, approved schools of forestry, the 1890 land-grant institutions and Tuskegee University, colleges of veterinary medicine, and other eligible institutions in the fifty States and in Puerto Rico, Guam, the Virgin Islands, the District of Columbia, American Samoa, Micronesia, and the Northern Mariana Islands.

The State institutions conduct research and experiments on the problems continuously encountered in the development of a permanent and sustaining agriculture and forestry, and in the improvement of the economic and social welfare of rural and urban families. Because of differences in climate, soil, market outlets, and other local conditions, each State has distinct problems in the production and marketing of crops and livestock. Farmers, foresters, and rural people in the individual States naturally look to their State Agricultural Experiment Stations, universities, and colleges for solution of the State and local problems and request services to help meet changing conditions.

Research programs at State institutions, to be most effective, include participation in regional and national programs. Joint effort by a group of State institutions is the most effective and often the only practical approach to problems of common interest. The stations are acting together as regional groups to provide cooperative, coordinated attacks on problems of regional and national interest. In a similar manner, the research programs of the State institutions and the Department of Agriculture are complementary and interdependent.

The Federal formula funds constitute a powerful force in bringing about inter-State cooperation and Federal-State collaboration in the planning and conduct of this overall program of agricultural research. Therefore, the impact of the Federal formula funds is far greater than would be expected solely on the basis of the amount of funds provided.

Research at the State institutions is organized into a program of projects that is submitted for approval by the Cooperative State Research Service. The program of projects is financed wholly or in part from Federal formula and grant funds. Programs and projects are evaluated periodically with station scientists by administrators and scientific staff of the Cooperative State Research Service. The evaluation includes consideration of quality and productivity of the program and projects. The continuing process of research evaluation by station scientists and the staff of the Cooperative State Research Service results in a dynamic program with approximately 15 to 20 percent of the projects being replaced by new and/or revised projects each year.

The Department's higher education mission is carried out in strong alliance with States, universities, and the private sector. Recognizing the significance of this alliance, the Food and Agriculture Act of 1977 designated USDA as the lead Federal agency for higher education in the food and agricultural sciences. Through the CSRS Office of Higher Education Programs, USDA has implemented that charge with a broad array of initiatives to link teaching, research, and extension and improve the training of food and agricultural scientists and professionals. Most of these efforts were informal until 1984, when the Department initiated the National Needs Graduate Fellowships Grants Program to develop expertise in areas with scientific shortages. This role was expanded significantly in recent years by implemention of the Higher Education Challenge Grants Program and the 1890 Institution Teaching and Research Capacity Building Grants Program, both of which are intended to strengthen the quality of education programs at U.S. colleges and universities.

Appropriations for the Cooperative State Research Service activities are authorized under the following Acts:

1. Payments to agricultural experiment stations under the Hatch Act - Agricultural Experiment Stations Act of August 11, 1955, Hatch Act of 1887 as amended - 7 U.S.C. 361a-361i, Public Law 92-318; Public Law 93-471; Public Law 95-113, as amended; Public Law 95-134; Public Law 96-205; Public Law 96-374; Public Law 96-597; Public Law 97-98; Public Law 98-213; Public Law 98-454; Public Law 99-198; Public Law 99-396; Public Law 101-624.

Funds under the Hatch Act are allocated to the State Agricultural Experiment Stations of the 50 States, District of Columbia, Puerto Rico, Guam, the Virgin Islands, Micronesia, American Samoa, and Northern Mariana Islands for research to promote a sound and prosperous agriculture and rural life. The Hatch Act provides that the distribution of Federal payments to States for fiscal year 1955 shall become a fixed base and that any sums appropriated in excess of the 1955 level shall be distributed in the following manner:

- -20% shall be allotted equally to each State.
- -not less than 52% shall be allotted to the States as follows:
  - one-half in an amount proportionate to the relative rural population of each State to the total rural population of all States, and
  - one-half in an amount proportionate to the relative farm population of each State to the total farm population of all States.
- -not more than 25% shall be allotted to the States for cooperative research in which two or more State Agricultural Experiment Stations are cooperating to solve problems that concern the agriculture of more than one State.
- -3% shall be available to the Secretary of Agriculture for the administration of this Act.

The Act also provides that any amount in excess of $90,000 available for allotment to any State, exclusive of the regional research fund, shall be matched by the State out of its own funds available for research, and for the establishment and maintenance of facilities necessary for the performance of such research. Also, in the case of Guam, the Virgin Islands, Micronesia, American Samoa, and Northern Mariana Islands, agencies are required by law to waive any requirement for local matching funds under $200,000. If any State fails to make available a sum equal to the amount in excess of their matching requirement to which it may be entitled, the remainder of such amount shall be withheld by the Secretary of Agriculture and reapportioned among the States.

Three percent of funds appropriated under the Hatch Act is set-aside for Federal administration. Administration includes disbursement of funds and a continuous review and evaluation of the research programs of the State Agricultural Experiment Stations supported wholly or in part from Hatch funds. The Cooperative State Research Service encourages and assists in the establishment of cooperation within and between the States, and also actively participates in the planning and coordination of research programs between the States and the Department at the regional and national levels.

2. Cooperative Forestry Research - The Cooperative Forestry Research Act of October 10, 1962, 16 U.S.C. 582a-7; Public Law 96-374; Public Law 97-98; Public Law 99-198; Public Law 101-624.

The Act authorizes funding of research in State institutions certified by a State representative designated by the governor of each State. The Act provides that appropriated funds be apportioned among States as determined by the Secretary after consultation with a national advisory council of not fewer than sixteen members representing Federal and State agencies concerned

with developing and utilizing the Nation's forest resources, the forest industries, the forestry schools of the State-certified eligible institutions, State Agricultural Experiment Stations, and volunteer public groups concerned with forests and related natural resources. Determination of apportionments follows consideration of pertinent factors including areas of non-Federal commercial forest land, volume of timber cut from growing stock, and the non-Federal dollars expended on forestry research in the State. The Act also provides that payments must be matched by funds made available and budgeted from non-Federal sources by the certified institutions for expenditure for forestry research. Three percent of funds appropriated under this Act is set-aside for Federal administration.

3. Payments to 1890 Colleges and Tuskegee University - The National Agricultural Research, Extension, and Teaching Policy Act of 1977, Section 1445, Public Law 95-113; Public Law 95-547; Public Law 97-98; Public Law 99-198; Public Law 101-624.

Public Law 95-113, as amended, provides for support of continuing agricultural research at colleges eligible to receive funds under the Act of August 30, 1890, including Tuskegee University. Beginning with fiscal year 1979, there shall be appropriated funds for each fiscal year, an amount not less than 15 percent of the total for such year under Section 3 of the Act of March 2, 1887. Distribution of payments made available under section 2 of the Act of August 4, 1965, for fiscal year 1978 are a fixed base and sums in excess of the 1978 level shall be distributed as follows:

- 3% shall be available to the Secretary of Agriculture.
- Payments to States in fiscal year 1978 is a fixed base. Of funds in excess of this amount:
  - 20% shall be allotted equally to each State.
  - 40% shall be allotted in an amount proportionate to the rural population of the State in which the eligible institution is located to the total rural population of all the States in which eligible institutions are located, and
  - 40% shall be allotted in an amount proportionate to the farm population of the State in which the eligible institution is located to the total farm population of all the States in which eligible institutions are located.

Allotments to Tuskegee University and Alabama A&M University shall be determined as if each institution were in a separate State. Three percent of the funds appropriated under this Act is set-aside for Federal administration.

4. Special Research Grants- Section 2(c), Act of August 4, 1965, 7 U.S.C. 450i(c), as amended by Public Law 95-113; Public Law 97-98; Public Law 98-284; Public Law 99-198; Public Law 101-624.

Section 2(c) of the Act of August 4, 1965, as amended, authorizes Special Research Grants for periods not to exceed five years to State Agricultural Experiment Stations, all colleges and universities, other research institutions and organizations, Federal agencies, private organizations or corporations, and individuals for the purpose of conducting research to facilitate or expand promising breakthroughs in areas of the food and agricultural sciences of importance to the United States; and to State Agricultural Experiment Stations, land-grant colleges and universities, research foundations established by land-grant colleges and universities, colleges and universities receiving funds under the Act of October 10, 1962, and accredited schools or colleges of veterinary medicine for the purpose of facilitating or expanding ongoing State-Federal food and agricultural research programs. Special Research Grants are awarded on the discretionary basis as well as using a competitive peer panel process in the selection of proposals to be funded. Four percent of funds appropriated for this program is set-aside for Federal administration.

Research grants are also awarded under the Critical Agricultural Materials Act, Public Law 98-284, as amended. Rangeland Research Grants are awarded in accordance with Subtitle M of Public Law 97-98. Grants are awarded to aquaculture centers under section 1475(d) of Public Law 95-113, as amended. Grants for supplemental and alternative crops are awarded under section 1473D of Public Law 95-113. Grants for sustainable agriculture research and education are awarded under section 1621 of Public Law 101-624. Grants for State agricultural weather information systems are awarded under section 1640 of Public Law 101-624. Three percent of funds appropriated for these programs is set-aside for Federal administration.

5. National Research Initiative Competitive Grants - Section 2(b), Act of August 4, 1965, 7 U.S.C. 450i(b), as amended by Public Law 95-113; Public Law 97-98; Public Law 99-198; Public Law 101-624.

Section 2(b) of the Act of August 4, 1965, as amended, authorizes Competitive Research Grants for periods not to exceed five years to State Agricultural Experiment Stations, all colleges and universities, other research institutions and organizations, Federal agencies, private organizations or corporations, and individuals to further the programs of the Department of Agriculture. By obtaining the participation of outstanding researchers in the entire U.S. scientific community, emphasis will be placed on research in the areas of natural resources and the environment; nutrition, food quality, and health; plant systems; animal systems; rural development, markets, and trade; and processing for value-added products. Four percent of funds appropriated for this program is set-aside for Federal administration.

6. Animal Health and Disease Research - The National Agricultural Research, Extension, and Teaching Policy Act of 1977, Section 1433, Public Law 95-113; Public Law 97-98; Public Law 99-198; Public Law 101-624.

Section 1433 provides for support of livestock and poultry disease research in accredited schools or colleges of veterinary medicine or State Agricultural Experiment Stations that conduct animal health and disease research. These funds shall be distributed as follows:

- -4% shall be retained by the Department of Agriculture for administration, program assistance to the eligible institutions, and program coordination.
- -48% shall be distributed in an amount proportionate to the value of and income to producers from domestic livestock and poultry in each State to the total value of and income to producers from domestic livestock and poultry in all the States.
- -48% shall be distributed in an amount proportionate to the animal health research capacity of the eligible institutions in each State to the total animal health research capacity in all the States.

Eligible institutions must provide non-Federal matching funds in States receiving annual amounts in excess of $100,000 under this authorization.

7. Federal Administration (direct appropriation) - Authority for direct appropriations is provided in the annual Agriculture, Rural Development, Food and Drug Administration and Related Agencies Appropriations Act. These funds are used to provide support services in connection with planning and coordination of all programs administered by Cooperative State Research Service. Certain research and higher education program grants, including the 1890 Institution Teaching and Research Capacity Building Grants Program, are also funded under this item.

8. Higher Education - The National Agricultural Research, Extension, and Teaching Policy Act of 1977, Section 1417, Public Law 95-113; Public Law 97-98; Public Law 99-198; Second Morrill Act of 1890; Public Law 100-339; Public Law 101-624.

Higher Education-Graduate Fellowships Grants pursuant to Section 1417(b)(6) are awarded on a competitive basis to colleges and universities to conduct graduate training programs to stimulate the development of food and agricultural scientific expertise in targeted national need areas. Typically graduate students in the food and agricultural sciences require a minimum of four years to complete a doctoral degree. The USDA fellowships program provides support for doctoral study for three years, and the universities are expected to support the student's fourth year of dissertation research. Three percent of funds appropriated for this program is set-aside for Federal administration.

Institution Challenge Grants pursuant to Section 1417 (b)(1) are designed to stimulate and enable colleges and universities to provide the quality of education necessary to produce graduates capable of strengthening the Nation's food and agricultural scientific and professional workforce. All federal funds awarded under this program must be matched by the universities on a dollar-for-dollar basis from non-Federal sources. Three percent of funds appropriated for this program is set-aside for Federal administration.

The Minority Scholars Program pursuant to Section 1417 (b)(2) will increase the ethnic and cultural diversity of the food and agricultural scientific and professional work force and advance the educational achievement of minority Americans. It is open to all colleges and universities with baccalaureate and higher degrees in Agriculture, Forestry, Natural Resources, Home Economics, Veterinary Medicine, and closely allied fields. Federal funds provide three years of scholarship support; the college or university provides the fourth year of support for completion of the baccalaureate degree. Three percent of funds appropriated for this program is set-aside for Federal administration.

Higher education in the food and agricultural sciences at the land-grant institutions is also supported through a permanent appropriation in the Second Morrill Act of 1890, as amended. Each state and territory receives $50,000 per year.

Audit Reports

#13099-01-KC, 1/24/92, OIC audit of Small Business Innovation Research Program for fiscal years 1987 and 1988 (open).

#13600-01-AT, 9/30/92, OIG audit of Cooperative State Research Service for fiscal years 1989 and 1990 (open).

#50563-83-KC, 2/6/92, OMB Circular A-110 audit of University of Missouri System, for fiscal year ended 6/30/90 (closed).

#50565-0-CH, 7/8/92, OMB Circular A-128 audit of University of Illinois, for 2-year period ended 6/30/90 (open).

#50568-246-KC, 4/2/92, OMB Circular A-128 audit of state of Iowa (Iowa State University) for the year ended 6/30/90 (open).

#50568-457-SF, 3/2/92, OMB Circular A-128 audit of state of Arizona for the year ended 6/30/89 (closed).

#50568-92-HY, 3/17/92, OMB Circular A-128 audit of Virginia Polytechnic Institute and State University for the year ended 6/30/90 (closed).

#50563-82-KC, 2/10/92, OMB Circular A-133 audit of University of Nebraska for year ended 6/30/90 (closed).

#50563-84-KC, 6/3/92, OMB Circular A-110 audit of Brigham Young University for year ended 8/31/90 (closed).

#7415- Single audit report, 8/31/92, OMB Circular A-133 audit of University of Alaska for fiscal years ended 6/30/90 and 6/30/91 (open).

#13097-1-TE, 8/10/92, OIG audit of Cooperative Agreements at Texas A&M University (open).

#50568-173-TE, 12/5/91, OMB Circular A-128 audit of Prairie View A&M University for year ended 8/31/90 (closed).

#50568-249-KC, 6/5/92, OMB Circular A-128 audit University of South Dakota for year ended 6/30/90 (closed).

Audits In Progress

Audit of Small Business Innovation Research Program
Audit of Cooperative Agreements

Program Reviews

RCDE-92-233, 9/30/92, GAO Review of Sustainable Agriculture: Program Management, Accomplishments, and Opportunities (open).

JUSTIFICATION OF INCREASES AND DECREASES

(1) An increase of $4,666,000 for payments to States under the formula provisions of the Hatch Act program ($168,785,000 available in 1993).

Need for Change. Agriculture continues to face many short-term challenges and a long-term need for new technology that will ensure competitiveness in both the domestic and international marketplace and at the same time preserve and protect our natural resources for future generations. The Hatch funds are the foundation upon which the remaining Federal funds build, including the National Research Initiative and Special Research Grants plus funds from the States and private industry. Funding of the Hatch program is a high priority because it supports the basic laboratory facilities, scientists, and graduate students necessary for the long-term stability of agricultural research. The Hatch program allows the Land-Grant Universities the maximum flexibility to support research of the highest priority and at the same time assure the strong working relationship between the USDA and the State Agricultural Experiment Station (SAES) System.

The SAES need increased resources to address high priority local, regional, and national food and agricultural research issues. The continuing awareness of the necessity for environmentally friendly technologies that enhance our natural and renewable resources, preserve environmental quality and still permit the production of food and fiber at the lowest possible cost is a continuing challenge for our National Cooperative Agricultural System.

Nature of Change. The requested resources will be used to assist the State Agricultural Experiment Stations in maintaining strong base programs across a broad spectrum of high priority research areas. The research conducted by the SAES has been complementary and cooperative with that performed by Federal researchers in contributing to the high level and efficiency of food and fiber production. The effectiveness of research is enhanced by comprehensive knowledge of the characteristics of the production areas and close interaction among the researchers and research users. Research is expanding into new areas and disciplines to meet such challenges as the development of new technology, crops, and markets. These funds will provide the State Agricultural Experiment Stations with continued flexibility needed to address high priority food and agricultural research issues, such as food safety, improved human nutrition, maintaining and protecting water quality and quantity, safe and effective management of plant pests, international markets and trade, and reducing disease losses in animals. The Budget proposes to increase the 1993 appropriation by 2.8 percent for increased operating costs.

(2) An increase of $512,000 for payments to States under the Cooperative Forestry Research program ($18,533,000 available in 1993).

Need for Change. The National Research Council's report, Forestry Research, A Mandate for Change, describes the need for increased forestry research funding to meet the needs of the Nation. Public interest in forestry and related environmental questions continues to increase rapidly. The need for forestry scientists will continue to increase throughout the world as we develop larger populations and ever increasing needs for wood. The universities wherein the Cooperative Forestry Research program is conducted have a very broad array of scientific capabilities which are available to work on these projects. Federal agencies frequently turn to these university scientists for the expertise to work on high priority problems. There is a close working relationship between CSRS, Forest Service, and the universities.

Nature of Change. Forest scientists must be educated by involving them in research projects. This program is unparalleled in its ability to produce the forest scientists which will be needed. The Budget proposes to increase the 1993 appropriation by 2.8 percent for increased operating costs. There is also an investment proposal of $9.0 million for this program on regional forest ecosystem research.

(3) An increase of $757,000 for payments to the 1890 Land-Grant Colleges and Tuskegee University under the formula provisions of the Evans-Allen program ($27,400,000 available in 1993).

Need for Change. The general public and the agricultural research and extension systems all have expressed concern for the prudent use and management of natural resources in the food and agriculture system. Stewardship of our environment and the development of new ways or new technology to minimize detrimental effects on natural resources is a major agenda for the agricultural system. More emphasis should be given to the efficient use of natural resources with increased attention on soil erosion, non-point pollution and water quality. The southern region where the 1890 Colleges and Universities are located is especially vulnerable to environmental damage of the natural resources because of high annual rainfall and erodability of the land. The region has a high density of small farms, and small farmers have not quickly put to use new conservation technology. Therefore, efforts to help small farmers conserve natural resources must be increased.

Nature of Change. Program emphasis will be changed to provide more research information to small farmers on specialty crops, innovative farm-based enterprises, diversified production, and natural resources management. The research will provide information for long-term solutions in natural resource management. Aquaculture research will focus on generating information of use to small farmers in management of water supplies and the pollution concerns associated with aquaculture water management. Emphasis on water quality and water quantity will be highlights of the research program. Researchers will investigate safe and efficient use of pesticides and will give increased attention to biocontrol. Social scientists will assess the implications of water quality impairment on human health and develop data on social behavior. More research is needed to determine production, use, fate and transport of contaminants and their affects on health and resource systems. Research is also needed to develop information on the assessment and integration of data for determining the impacts of agricultural practices on other organisms and ecosystems. The Budget proposes to increase the 1993 appropriation by 2.8 percent for increased operating costs.

(4) A net decrease of $37,650,000 for Special Research Grants, Aquaculture Centers, Sustainable Agriculture, Rangeland Research, Supplemental and Alternative Crops, Critical Agricultural Materials Act, and State Agricultural Weather Information Systems ($86,579,000 available in 1993) consisting of:

(a) An increase of $1,000,000 for Energy Biomass/Biofuels Special Research Grant (No funding available in 1993).

Need for Change. There is a serious need to stimulate the use of transportation biofuels through a research program focused on substitution of renewable biomass energy sources, such as ethanol and biodiesel. Agriculture in the United States has a tremendous capacity to increase starch-derived ethanol as well as to produce herbaceous and woody biomass feedstocks for conversion into ethanol. Biomass fuels are being used, both on and off the farm, however, these fuels are far from reaching their potential. The potentials are many faceted: There are economic benefits

to producers of the feedstocks, rural jobs for those involved in conversion, marketing, etc., and major environmental benefits from cleaner sources of energy. Use of biofuels could eventually decrease the amount of fossil fuels needed from foreign sources, and reduce farm program costs resulting in a more favorable trade balance and a reduction in the amount of carbon currently being injected into the atmosphere from fossil fuels. Additional ethanol could be made from corn without adversely impacting food costs. There are also other grain crops and lignocellulosic feedstocks that are potential sources for alcohol production. Diesel fuels can be made from vegetable oils including sunflower, safflower, soybean, cottonseed, rapeseed, canola, corn, coconut, and peanut oils or animal tallow.

Nature of Change. Use of biomass for transportation fuels provides for a short carbon cycle (versus a long cycle through fossil fuels) and lower net carbon contribution to the atmosphere when compared to conventional fuels. In general, biofuels result in lower airborne pollutants compared to coal and petroleum fuels. The challenge for this $1 million research program is to help find ways of reducing the costs for ethanol associated with the production/collection of feedstocks, improving the yields and conversion rates of alcohol processes, and developing new uses of the co-products. In addition, improved yields of oilseed crops, improved extraction processes, the development of improved technologies to modify the chemical and physical properties of oils, and the development of new uses for the co-products will result in more acceptable biodiesel fuels at lower costs. Additionally, more jobs will be created and the U. S. economy will benefit.

(b) An increase of $1,000,000 for Global Change Special Research Grant ($2,000,000 available in 1993).

Need for Change. There is a lack of data on the geographical and temporal trends in UV-B radiation. A monitoring network is essential to determine these trends as this part of the solar spectrum can be detrimental to crops, trees, animals and humans. During the past several years, there are indications that as a result of stratospheric ozone reduction, there could be an increase of UV-B radiation at the earth's surface. This increase is needed for expansion of the monitoring network. It has been reviewed and coordinated with other Federal research agencies through a government-wide global change initiative.

Nature of Change. Total funding of $3,000,000 for UV-B will allow for the expansion and operation of a national monitoring network for obtaining base line UV-B information at ground level. As envisioned, the overall operation of this program will include the development of 6-8 intensive sites at which sophisticated research instruments will be used to collect very high quality data; deploy a network of less costly, rugged field instruments which will provide more complete trends and status data; and build a network with a capacity to interact with both types of instruments and make the data available to scientists and the public.

(c) An increase of $2,543,000 for Integrated Pest Management and Biological Control Special Research Grant ($4,457,000 available in 1993).

Need for Change. Limitations to continued use of pesticides are increasing because of concerns for human health, ground and surface water contamination, loss of effectiveness due to pest resistance, affects on non-target species, and cancellation of pesticide registrations. With the diminished utility and confidence in pesticides and the very great losses that pests can cause, it is imperative to mobilize the best scientific talent of this country to develop and sustain agricultural production. To address this national need, the Pest Management Strategies Subcommittee of Experiment Station Committee on Organization and Policy (ESCOP) in

collaboration with the National Association of State Universities and Land-Grant Colleges and CSRS has developed a plan entitled "Blueprint for Integrated Pest Management for the 21st Century." This plan identifies strategies that enhance natural controls (biological control, cultural control, and host resistance) of pests as the primary focus of effective pest management. Biological control has been targeted as the first priority of increased emphasis because it has the greatest untapped potential for enhancing natural controls in the environment. Another important component is resistance management through a better understanding of adaptive genetics. These management practices will slow the loss of pesticides due to pest resistance, decrease the extent to which pests overcome host resistance, and reduce environmental concerns by promoting the judicious use of pesticides where they complement biological controls.

Through a multi-agency effort (APHIS, ARS, CSRS, ES, and FS), a National Biological Control Program (NBCP) has been established. The NBCP allows for greater and more effective collaboration and coordination among USDA agencies and makes it possible to launch coordinated basic and applied research, demonstration, and education programs in response to economic and environmental concerns. The trend toward an accelerated removal of chemical pesticides from the arsenal of pest management options is a mandate for future planning by the agriculture research and education community. The transition away from a dependency on chemical pesticides will require public support for basic and applied research as well as for an intensive education program. Each of the USDA agencies involved in the NBCP have unique and interdependent strengths to bring to this initiative. The NBCP will benefit agricultural producers, forest managers, urban residents, and the general public as well as be a centerpiece for progressive, environmentally sound pest management in the USDA and our partner Land-Grant Universities.

In addition to research on specific control tactics such as biological control, there is a great need for research dealing with the integration of data derived from pest management research spanning traditional disciplinary boundaries. Such integrative research is key to pest management decision-making. Currently, most pest management decisions are based on a small fraction of the information that is needed to make appropriate integrated decisions. Some of the needed information is available and some still needs to be developed through additional research. Research on integrative pest management differs from research that addresses specific tactics in that a coordinated approach is required and multidisciplinary collaboration over time is usually necessary. Integrative research focuses on the construction of comprehensive pest and crop management systems which support sustainable agriculture. Interagency collaboration is being developed through the USDA Integrated Pest Management Working Group in interaction with EPA.

Nature of Change. The Integrated Pest Management Special Research Grant program is administered by CSRS through four competitive grants programs in the Southern, Northeastern, North Central, and Western regions of the United States. Each region has an established IPM grants program that reflects both the special needs of the region and the overall programmatic direction provided by ESCOP and CSRS. A $7 million program will allow for regional IPM programs in three program areas: Integrative Research, Biological Control, and Emerging Pests.

Integrative Research ($4.182 million, same as 1993). Pest management integrative research encompasses the dynamics of integrating pest management tactics into comprehensive systems and allows for the evaluation of these systems. Research commonly focuses on multiple strategies to manage one or more types of pests on a single commodity, but may ultimately

involve multi-crop or complex livestock production systems. This program area also provides support for pest management research that will receive priority attention in a later phase of the regional IPM program development. This includes research on application technology, cultural control, host plant resistance, and resistance management.

Biological Control ($2.218 million, an increase of $1.943 million over 1993). In conjunction with the National Biological Control Program working through the regional IPM grant program, CSRS will support biological control research and development. Basic and applied research will be conducted to determine mechanisms of biological control and to determine the role of native beneficial organisms and learn how to manipulate and enhance their effect by crop rotation, varietal selection, and other cultural methods. Methods to propagate beneficial microbes or predators and parasites and approaches to mass release and distribution will be investigated. Natural enemies of imported pests will be sought and introduced for control. Biological control is appropriate for many pests including viral diseases, such as barley yellow dwarf and citrus tristeza; nematode pests, such as cyst nematodes; and insect pests, such as sweet potato whitefly, European corn borer, cockroaches, fruit flies, stored grain beetles and moths, mites, facefly, Gypsy moth, boll weevil, bollworms, housefly, diamond-back moth, etc.

Emerging Pest Issues ($600,000). Farmers face continually changing pest problems, for which effective controls are frequently not readily available. Recent examples include the Russian wheat aphid and the sweetpotato whitefly which have become pests in major crop production areas. There is a need for additional research into basic biology, ecology and population dynamics for emerging pests so that effective controls can be developed. Funds are proposed to support a nationwide program of competitively awarded grants to address newly emerging pest issues. Grants will support the development of a better understanding of the pests and research to begin the development of improved controls. Research conducted through this program will be closely coordinated with ARS, APHIS and Extension programs.

This special research grant program complements the National Research Initiative (NRI) by developing innovative information from the NRI program. Regional IPM funds provide the critical conduit that takes basic knowledge and develops pest, crop, and region specific crop and pest management systems. Further, investigators and working group members within the integrated pest management and biological control program identify basic research priorities to the NRI where information gaps impede the development of alternative pest management strategies.

(d) <u>An increase of $186,000 for Minor Use Animal Drugs Special Research Grant ($464,000 available in 1993).</u>

<u>Need for Change</u>. Funds will address the increasing need for registration of safe animal drugs and biologics for minor uses and minor species. The unavailability of such drugs, requisite to adequate animal health and protection, results in serious economic losses to producers and threatens the economic viability of some animal industries. For example, a recent workshop, involving the U.S. Department of Agriculture, the U.S. Food and Drug Administration (FDA), university scientists, aquaculture producers, and representatives from pharmaceutical industries, identified several high priority research needs for the rapidly growing aquaculture industry. Currently there are very few approved drugs to help control diseases and parasites in aquaculture species.

The high cost incurred to obtain the extensive experimental data on efficacy, safety, and residue depletion, required by Federal and local

regulations, cannot profitably be borne by the animal and pharmaceutical industries. The IR-4 Minor Use Animal Drugs Program, (A National Agricultural Program to Clear Pest Control Agents and Animal Drugs for Minor Uses), working cooperatively with FDA, provides the only remaining alternative to approve these types of drugs. The program is a prime example of Federal interagency cooperation in coordination with academic institutions, pharmaceutical industries and commodity interests to effectively meet an urgent need.

Nature of Change. Grants for the IR-4 Minor Use Animal Drugs Program are awarded by USDA in support of the National program to obtain clearance, by FDA, of animal drugs and biologics for minor uses and minor species. The increase will stress the expanding needs for many species with emphasis on the aquaculture industry.

To date, the program has received 227 requests for clearances. Nineteen public master files, which involve 14 new animal drugs in 10 animal species, have been published in the Federal Register related to the use of specific drugs in minor animal species. Nine additional public master files are currently being reviewed by FDA. Research is also being conducted on 19 ongoing projects in conjunction with many universities, the U. S. Department of Interior (Fish and Wildlife Service), and the USDA-Agricultural Research Service. The IR-4 Minor Use Animal Drug Program continues to benefit from the eighteen pharmaceutical companies that have cooperated on animal drug research projects for this program.

(e) An increase of $6,500,000 for Pesticide Clearance Special Research Grant ($3,500,000 available in 1993).

Need for Change. The 1988 amendments to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) have created a serious potential loss of over 3,500 pesticide uses important to minor crops farmers. If American agriculture is to have available the legally registered materials necessary to provide for a wholesome and nutritious diet for the consuming public and to supply them with the ornamental plants to beautify their environment, it is essential to meet these regulatory demands.

The recent FIFRA amendments greatly accelerated the need for reregistration of many currently used pesticides. Reregistration of previously registered pesticides will require redoing much of the original research using current state-of-the-art technology. There is no patent protection and very little economic incentive for commercial companies to reregister these older pesticides, especially for minor uses. In contrast, the economics to the user are excellent, and further, these older pesticides have been researched and incorporated into sound environmental management systems. Their loss would be a severe restriction to pest management programs.

CSRS appointed a review team comprised of representatives of State Agricultural Experiment Stations, Federal agencies involved in IR-4, the pesticide industry, and producer groups to examine the IR-4 program. Their report (February 1991) concluded that IR-4 needs a significant increase in its direct funding in order to serve the needs of the $19.3 billion minor crop industry in a timely and comprehensive fashion. A GAO audit noted that "IR-4 officials believe that the IR-4 research grant project makes effective use of its limited resources... This is because IR-4 uses the existing land-grant university infrastructure, targets its research agenda to include those pesticide uses most likely to be approved by EPA, and annually reviews its research priorities." The report concludes with criticism of "...USDA... (having) been slow to respond to the need for pesticides on minor crops, even though IR-4 officials at the regional level developed a strategic plan in 1989 to address this need."

Nature of Change. The increased support is required for the expansion of the reregistration process for minor use agricultural commodities and the initial registration of safer and more environmentally compatible pesticides. The program is addressing requests for assistance in the registration of both food and ornamental crops. IR-4 receives about 375 valid requests from growers, extension personnel, research scientists and ranchers each year and has a large backlog of valid researchable requests, currently approaching 2,200. These increased funds will support the completion of significantly more tolerance projects. To meet these demands, the research activities of the IR-4 program will be expanded to include additional field experiments and the resultant chemical analyses for residues. All requests are rigorously reviewed and addressed in order of priority. Producers can increase the priority of their request by contributing funding. IR-4 staff encourage producers to contribute to the cost of reregistration. The final product of the increased support will be an increased number of chemical and biological products available for use on minor crops. The research effort of IR-4 is highly mission oriented and does not lend itself to the highly competitive, fundamental research of the NRI program.

(f) An increase of $50,000 for Water Quality Special Research Grant ($8,950,000 available in 1993).

Need for Change. Efforts must continue on research initiatives begun in response to the government-wide initiative and the USDA Research Plan for Water Quality, so we can more adequately understand processes involved in contamination, and learn how to avoid unacceptable degradation of water resources by use of improved and thoroughly evaluated crops and soil management practices. The USDA Water Quality Plan includes two parts: a national grants program, designated as the National Components Initiative and a Selected Geographic Areas which is an integrated systems approach in high priority areas begun in FY 1990 as the Midwest Initiative.

Nature of Change. The systems approach to evaluating the effects of current and alternative farming systems on ground water quality, now being used in the Midwest Initiative and other areas, needs to be expanded. Increased funds will be used to provide additional support for the Selected Geographic Areas program for implementing interdisciplinary systems research. Some or all of these areas will be planned and established jointly with ARS, ES, SCS, USGS, EPA, and other agencies as appropriate in support of the USDA water quality program.

(g) An increase of $14,000 for Rangeland Research Grants which reflects a 2.9 percent increase in operating costs.

(h) An increase of $111,000 for Aquaculture Centers which reflects a 2.8 percent increase in operating costs.

(i) An increase of $186,000 for Sustainable Agriculture which reflects a 2.8 percent increase in operating costs.

(j) An increase of $1,832,000 for Advanced Materials under Supplemental and Alternative Crops ($1,168,000 available in 1993).

Need for Change. CSRS is one of three USDA agencies participating in the FCCSET Advanced Materials and Processing Program (AMPP) crosscut, a Presidential Initiative which recognizes that materials are the basis of a critical enabling technology upon which most other technologies depend for their success. The expanded role for CSRS in developing advanced products

and processes for agricultural industrial materials fosters continued leadership in this area of materials science technology. Although technology development by itself is significant, CSRS's participation with other USDA agencies is as a co-equal with other agencies such as DoD, NASA and DOE. This boosts the image of agriculture in science and technology and opens our laboratories and scientists to broader exposure and utilization.

Nature of Change. The AMPP for CSRS calls for an intense commercialization program for uses of vegetable oils that provide materials of strategic and industrial importance. Development of functional fluids from erucic acid oils and derivatives will occur in 1994 with validation and scale-up of technologies, especially for nylon 1313 from brassylic acid. The 1994 program significantly expands earlier characterization work for hydroxy fatty acid oils and derivatives to develop specific product applications for comparative testing and market assessment. Other vegetable oils and other materials may be added. This comprehensive development program will involve private companies, government and universities in a multi-year partnership that joins resources, facilities and ideas. A successful process will require a management team to establish and evolve a program which progressively removes barriers to commercialization and adjusts work goals and objectives as progress is made.

(k) A decrease of $38,993,000 for Special Research Grants, $400,000 for Critical Agricultural Materials Act, and $400,000 for State Agricultural Weather Information Systems.

Need for Change. These grants programs have concentrated on specific problems beyond the normal emphasis in the formula based programs. The Hatch Act and related formula based programs constitute the core of the State-Federal research partnership and, when put together with State funding, provide the basic laboratory facilities, scientists, graduate students, and support necessary for the long term stability of agricultural research. Thus, these formula based programs become the highest priority of the State-Federal research partnership. Selected high priority National interest special research grant programs will be continued.

Nature of Change. This change will eliminate this specific funding support for selected grant programs. Due to the discretionary nature of the Hatch Act and related formula based programs, amounts allotted to State institutions permit the institutions to fund research in those areas that they identify as high priority. This flexibility could provide for maintaining some of the programs if the State institutions wish to continue the research. These projects could also be submitted for competition and possible funding under the National Research Initiative.

(5) An increase of $2,695,000 for the National Research Initiative Competitive Grants Program ($97,500,000 available in 1993).

Need for Change. Agriculture in the 1990's must provide stewardship of the environment, encourage more rational use of natural resources, improve the quality and nutrient content of food, provide new demand opportunities for agricultural commodities and forest products, and reduce farm program costs in order to continue to benefit producers as well as consumers. This Initiative responds to the major issues facing agriculture such as sustainable agroecosystems, food safety, new uses and biofuels development, water quality, global climate change, integrated pest management, biological controls, rural development, scientific human capital development, farm income and market competitiveness. It allows U.S. agriculture to broaden its science and technology base to meet more effectively these demanding needs and exploit new opportunities. These

imperatives coincide with recent advances in biology and with other new tools in science that present unique research opportunities for improving agriculture.

A 1989 report from the National Academy of Sciences (NAS) (Investing in Research: A Proposal to Strengthen the Agricultural, Food, and Environmental System) recommended the establishment of the National Research Initiative (NRI) with new funding of $500 million per year. The NRI was broadly endorsed by users of research and provides increased Federal support for agricultural research awarded on a competitive basis.

Section 1402 of the National Agric. :ural Research, Extension, and Teaching Policy Act of 1977, as amended by Section 1602 of the FACT Act of 1990, requires that research supported by the NRI address, among other things, one or more of the following purposes of agricultural research and extension:

1) continue to satisfy human food and fiber needs;

2) enhance the long-term viability and competitiveness of the food production and agricultural system of the United States within the global economy;

3) expand economic opportunities in rural America and enhance the quality of life for farmers, rural citizens, and society as a whole;

4) improve the productivity of the American agricultural system and develop new agricultural crops and new uses for agricultural commodities;

5) develop information and systems to enhance the environment and the natural resource base upon which a sustainable agricultural economy depends; or

6) enhance human health by fostering the availability of a safe, wholesome, and nutritious food supply that meets the needs and preferences of the consumer and by assisting farmers and other rural residents in the detection and prevention of health and safety problems.

Federal funding for the Initiative is necessary because: (1) the issues and opportunities are national in scope; the nation as a whole is the beneficiary of this effort, not just individual states or industries, (2) the Initiative undertakes research that increases knowledge that will be broadly applicable and that may lead to specific patentable or marketable products, (3) the need is urgent; the issues described below require action now and cannot be delayed or initiated piecemeal, (4) the health and vigor of a major segment of U.S. industry is at stake in terms of international competitiveness, and (5) there are major benefits that will result from protection of the environment and enhancement of public health.

The National Research Initiative is designed to conduct basic and mission-linked research on agricultural problems. The knowledge developed in concert with base programs will then be made available to American user groups including applied and developmental research laboratories. Both intramural programs and nationally focused State Agricultural Experiment Station programs are also important to maintaining national thrusts in agricultural research in established laboratories. Extension has a vital role in this program as a participant in research proposals focusing on adaptive research and on the transfer of technology.

A major infusion of new funding is needed to allow the strengths of current research funding mechanisms to do best what each is designed to accomplish. Each mechanism supports the others through a balanced investment in the entire spectrum of agricultural research needs.

This Initiative strengthens the USDA intramural program, since USDA scientists are eligible to compete for the grants. It also strengthens the extramural program by extending support to other outstanding scientists outside the realm of traditional agricultural institutions to address national agriculture and natural resource problems.

Nature of Change. Approximately 70 percent of the effort proposed in the NRI supports fundamental research emphasizing the most urgent agricultural and natural resource problems. It is from this research that major conceptual breakthroughs are expected to emerge. These breakthroughs are critical to the eventual solution of complex problems faced by farmers, foresters, ranchers, processors, and consumers. Mission-linked research, also supported by the NRI, is expected to bridge the gap between fundamental and applied research and technology development. In addition to single disciplinary research, the following types of research are supported.

Fundamental Research: Research that tests scientific hypotheses and provides basic foundation knowledge that supports applied research and from which major conceptual breakthroughs in agricultural research are expected to occur.

Mission-linked Research: Research on specifically identified agricultural problems which, through a continuum of efforts, provides information and technology that may be transferred to users and may relate to a product or process.

Multidisciplinary Research: Research in which scientists from two or more disciplines are collaborating closely. These collaborations, where appropriate, may integrate the biological, physical, chemical and/or social sciences.

Funds are awarded on a competitive, peer reviewed basis. This form of funding mechanism is uniquely suited to stimulating new research activity in specific, high-priority areas of agricultural science and engineering. All public and private universities, research organizations, Federal agencies, private organizations or corporations, and individuals are eligible to compete for these funds.

There are six research components proposed in the Initiative:

Natural Resources and the Environment. Research activities are directed to increase understanding of agriculture and natural resource systems in order to enhance stewardship and encourage protection of the environment. Understanding the effects of potential global climate change on natural resources, agriculture and the environment will be a major area of endeavor. Research will also address the effects of agriculture on water quality by supporting research which examines underlying mechanisms in order to provide the knowledge necessary to develop methods for water quality enhancement. In addition, feedstocks research for new uses and biofuels will be supported. Sustaining agriculture as an environmentally and economically sound enterprise requires improved understanding of the natural resource base upon which agriculture and forestry is dependent.

Nutrition, Food Quality and Health. Human nutrition research is needed to investigate the relationships of human health to diet and nutrition and to food quality and safety. Further, a better understanding of factors

impacting consumer behavior is needed, particularly in the areas of obstacles to healthful food habits and contemporary eating behaviors. Improvements in survey techniques are needed that are more sensitive and that can be used to monitor knowledge and attitudes about food and health. Growing consumer expectations for certain types and wholesomeness of food, as well as food safety, have placed new demands on food production and processing technology.

Plant Systems. A redoubling of effort is needed to explain the basic biological processes of crop and forest species, to search for new production systems that are low-input and sustainable and to find alternatives for present practices which degrade the environment or are not profitable. The present "reservoir of scientific knowledge" supporting the plant sciences is inadequate for future needs. This knowledge base must be replenished to allow for more environmentally harmonious, economically viable forest and crop production systems. A fundamental understanding of the biology of crop and forest species is prerequisite to sustaining natural resource productivity, understanding the impact of global change, devising practices that insure the compatibility of natural resources and the environment, and developing sound pest control strategies. The plant genome mapping program will continue to be an integral part of the plant systems research category in cooperation with the Agricultural Research Service as the lead agency.

Animal Systems. Animal agriculture includes livestock, poultry and the rapidly emerging industries of aquaculture and non-traditional species. Research across a broad range of animal science areas is urgently needed for the future sustainability of animal production efficiency as well as to address such areas as the modification of animal products. Proposed research will apply advanced research tools including genome mapping and genetic engineering to understand the mechanisms which control fat deposition, animal disease, animal well-being and reproduction and use that knowledge to address production and consumer issues.

Processing for Value-Added Products. This initiative will focus upon research planned to design or originate new or improved, value-added food, non-food, non-feed products from agricultural materials. Through the application of the biological and physical sciences, food, non-food and industrial uses, which are safe, energy-efficient, environmentally-sound and economical will be sought. Additional basic studies should increase the understanding of the physical, chemical and biological properties of the agricultural materials that may be improved through innovative processing and/or in enhancing and controlling the quality of food and non-food, non-feed products. Presently, only a third of the U.S. agricultural exports are high value-added products. New technology and processes such as bioprocessing present major opportunities for producing goods that will increase the U.S. trade advantage. This research represents a priority for U.S. agriculture and should benefit farmers, related industries and consumers.

Rural Development, Markets and Trade. Research is needed to describe and measure the forces that reduce economic vitality and guide the policies that can restore vitality of rural areas. New critical thinking also is needed to provide new theories, concepts, and methodological techniques for developing rural revitalization policies. U.S. agricultural markets and international trade must be expanded in ways to enhance economic growth and relieve the Federal Government from fiscally burdensome commodity programs. This must be done through a well-coordinated program based on sound scientific principles that will bolster U.S. marketing and trade. Research on the market opportunities and trade implications of new uses for agricultural commodities will also be supported.

The Budget provides $2.695 million for increased operating costs and there is also a $30 million investment proposal for the NRI for a total request of $130,195,000. As shown below, the six NRI categories will have significant impact on programs in the Department's initiatives on water quality, global change, biofuels, food safety, biotechnology, human nutrition, new uses and products, forestry, and pesticide related programs. These 1994 estimated levels include funding from the $30 million NRI investment proposal. Emphasis will continue to be placed, where appropriate, on long- and short-term research to insure a sustainable agricultural system.

Funding from NRI for Selected Areas
(Dollars in Thousands)

Crosscut Area	1991	1992	1993	1994 Request
Water Quality	4,609	4,629	4,629	5,600
Global Change/MARS	9,555	9,400	9,400	9,861
Food Safety	1,266	3,440	3,440	5,000
Human Nutrition	2,734	3,826	3,826	8,000
Plant Genome	11,075	12,309	13,000	13,000
Biofuels	514	500	750	1,000
Biotechnology	29,171	38,152	38,152	41,948
New Uses	2,291	6,053	6,053	11,053
Forestry	7,941	9,508	9,508	10,508
Biological Control	4,496	3,250	3,250	4,496
Integrated Pest Management	5,405	6,369	6,369	6,573
Advanced Materials	573	1,690	1,690	2,190
Advanced Manufacturing	0	939	939	939
Wetlands	599	1,299	1,299	1,299
Sustainable Agriculture	7,446*	10,640*	10,640	13,000

*The funds designated as sustainable agriculture were categorized as either site-specific or identifiable as impacting directly on the objectives of sustainable agriculture. A high percentage of NRI funds can be considered to contribute to sustainable agriculture.

New uses for agricultural materials will be developed based on research carried out under the NRI. Energy biomass research on alcohol and biodiesel fuels made from agricultural and forestry feedstocks and the technologies for this conversion will be conducted. The knowledge necessary for enhanced process efficiencies and innovative processing/preservation methods for conversion of agricultural materials into new value-added food and especially non-food products will be sought. Such research will emphasize processes that are environmentally acceptable, cost effective and will identify potential applications or market needs.

The NRI is strongly supported by the Administration as well as numerous producer and trade associations and advisory groups. It has also attracted the strong support of the scientific community throughout the United States. The NRI is of critical importance to the future of American agriculture and has been a successful mechanism to increase the investment in agriculture research in recent years. Congress has fully endorsed the NRI in the 1990 Farm Bill and with funding increases without earmarking.

(6) A decrease of $5,551,000 for Animal Health and Disease Research, Section 1433, P.L. 95-113 ($5,551,000 available in 1993).

Need for Change. The Animal Health and Disease Research program has provided funds on a formula basis for livestock and poultry disease research at accredited colleges of veterinary medicine and State Agricultural Experiment Stations. Some aspects of this program may be continued under the expanded Animal Systems component of the National Research Initiative which will target funds to projects of highest scientific merit and most closely tied to national priorities.

Nature of Change. This change will eliminate formula funding for this program. Animal health and disease research is being conducted in other ongoing Federal and State research programs. Certain aspects of the CSRS animal health research previously conducted under this formula program may be continued under the Animal Systems component of the National Research Initiative which will provide a focus for innovative approaches to solving fundamental problems in animal health and disease in food and fiber animals.

(7) A net decrease of $7,154,000 for Federal Administration (direct appropriation) ($20,795,000 available in 1993) consisting of:

(a) A decrease of $7,543,000 for the following projects ($7,543,000 available in 1993):

-3,500,000	Gulf Coast shrimp aquaculture
-668,000	Curriculum development and strengthening, Mississippi Valley State University
-750,000	Center for Agricultural and Rural Development, Iowa
-1,000,000	Geographic information system pilot program
-500,000	Vocational aquaculture education curriculum
-400,000	Maize Genetics Research Center, University of North Dakota
-475,000	Herd management program, Tennessee State University
-250,000	Alternative Fuels Characterization Lab, U. of North Dakota
-7,543,000	TOTAL

Prior funding has supported the initial development of these projects. Emphasis is placed on high priority national interest programs in the 1994 CSRS budget.

(b) A decrease of $1,250,000 for water quality research in Illinois and North Dakota. Prior funding has supported the initial development of these projects. Funding is requested for water quality under the Special Research Grants program, as part of the Federal government's water quality initiative, and these States may compete for these funds. Water quality research is also conducted through the National Research Initiative Competitive Grants program.

(c) A decrease of $8,000 for FTS 2000 in the Office of Grants and Program Systems.

This decrease reflects lower long distance telecommunications prices due to price redeterminations in the FTS 2000 contracts.

(d) A decrease of $218,000 for administrative efficiency in the Office of Grants and Program Systems.

Need for Change. To promote the efficient use of resources for administrative purposes in keeping with the President's Executive Order, total USDA baseline outlays for these activities will be reduced by 3 percent in fiscal year 1994, 6 percent in fiscal year 1995, 9 percent in fiscal year 1996, and 14 percent in 1997.

Nature of Change. In order to achieve this savings, CSRS will carefully monitor supply and equipment purchases, printing and reproduction costs, and travel costs. CSRS may also have to reduce support for conferences/symposia and other planning and coordination activities with the State institutions.

(e) An increase of $8,000 for the Agriculture in the Classroom program ($208,000 available in 1993). In order to educate, inform, and bring about a better appreciation and understanding of American agriculture among the nation's young people, USDA established the "Ag in the Classroom" program. Administrative responsibility for the "Ag in the Classroom" program has been assigned to the Assistant Secretary for Science and Education. The number of State participants in the "Ag in the Classroom" program continues to grow leading to an increased demand for materials, newsletters, and other information. Increased funding is needed for the development, printing and distribution of this information to the States.

(f) An increase of $240,000 for peer panel costs ($260,000 available through direct Federal administration in 1993). Cooperative State Research Service uses the peer panel review process to evaluate proposals submitted under the National Research Initiative, Special Research Grants program, Higher Education programs, Rangeland Research Program, and Small Business Innovation Research program. This request provides for the cost of travel and honoraria for the peer panel members. Additional peer panel costs are met through set-asides from program funds. Growth in the CSRS grants programs results in the need for more peer panels and these additional funds are needed for the increased costs associated with travel and honoraria for the peer panelists.

(g) An increase of $367,000 which reflects the annualization of the fiscal year 1993 pay raise.

(h) An increase of $1,250,000 for the 1890 Institution Capacity Building Grants Program ($10,250,000 available in 1993).

Need for Change. The Committee on Education and Human Resources (CEHR) of the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET) has underscored the urgent need to train more minority scientists and professionals. The 1890 land-grant institutions and Tuskegee University are major producers of this sorely needed human capital. By strengthening the teaching and research infrastructure of these institutions, the Department can play a vital role in augmenting the development of minority expertise for food and agricultural science and business.

The Capacity Building Program is definitely strengthening the 1890 land-grant institutions. The emphasis on partnerships is evidenced by consistent contributions of notable non-Federal matching funds. Strong linkages between the 1890 and 1862 land-grant universities are being forged. Also, a steady growth in the number of USDA agencies serving as cooperators on funded Capacity projects has occurred, thereby strengthening departmental partnerships and linkages with these important minority

institutions. Under the Capacity Building Program, more faculty are involved in research and education programs now than previously, leading to significant professional growth on the part of the 1890 faculty. The program is supporting students at the 1890 institutions, including salaries for research associates, postdoctorates, graduate students, and pre-baccalaureate students associated with research projects, as well as direct student support in the form of scholarships, stipends, and tuition. Scientific instrumentation, both for research and teaching purposes, purchased under this program is increasing the system's competitiveness in high priority research areas and in the quality of education delivered to student populations. Further, the Capacity Program is helping the institutions develop skills for competing successfully in the overall Federal grants arena. Therefore, it should open up a much broader array of funding opportunities for them in the future.

Nature of Change. The 1890 Institution Capacity Building Grants Program serves as the crux of the Department's high priority initiative to advance the teaching and research capacity of the 1890 institutions and Tuskegee University. It is competitive and strongly encourages matching funds from non-Federal sources. It also requires cooperation with one or more USDA agencies in developing a proposal and in implementing and carrying out a capacity building project. This increase provides support for additional projects each year as well as generates additional private and/or State support.

(8) A net increase of $1,139,000 for Higher Education programs ($7,850,000 available in 1993) consisting of:

(a) An increase of $97,000 for Graduate Fellowships Grants ($3,500,000 available in 1993).

Need for Change. U.S. leadership in science and in science education is facing pressing challenges on many fronts. These challenges span the full spectrum of K-12, undergraduate, and graduate education. Since being launched in FY 1984, the USDA National Needs Graduate Fellowships Grants Program has become a key mechanism for recapturing excellence in food and agricultural sciences graduate education. It serves both to recruit and train academically outstanding graduate students and to strengthen the quality of graduate programs and faculty. Hence, it is a major force in developing excellence in the food and agricultural scientific and professional work force. Although the program is less than a decade old, it has already produced scientists who have begun promising careers in USDA's Federal laboratories, on university faculty, and in private research and development operations. These young men and women hold great potential for developing new knowledge and technologies to advance the food and agricultural system. The FCCSET/CEHR Strategic Plan urges Federal agencies to capitalize on our existing strengths in mathematics, science, and engineering graduate education to continue those programs that have been so successful. Yet, the FY 1993 level of support for this program allows recruiting only about 60 doctoral fellows annually, restricting its potential benefits.

Nature of Change. This increase will raise the number of new fellows recruited each year to 68 doctoral students. With this level of support, over the next decade the program would produce an additional 680 doctoral graduates with outstanding training.

(b) An increase of $42,000 for Institution Challenge Grants ($1,500,000 available in 1993).

Need for Change. Given the intense problems currently impacting negatively on the U.S. education system, the President and FCCSET/CEHR have urged that every Federal agency undertake an expanded agenda to promote excellence in education--particularly that sector of education relating directly to an agency's mission. The USDA Institution Challenge Grants Program contributes directly to the National Education Goal of U.S. students being first in the world in science and mathematics achievement by the year 2000. This program relates specifically to the FCCSET-CEHR implementation priorities for undergraduate education and has received highest commendations from the university community. Moreover, it requires dollar-for-dollar matching support, thereby doubling the Federal investment and establishing several exciting partnership ventures. Unfortunately, over the last three years only 14 percent of the excellent proposals generated in this highly competitive process could be funded. Education problems and needs are compounding while university and State resources are diminishing.

This program meets several critical needs of U.S. colleges and universities in their efforts to produce world-class scientists and other professionals. It provides grants that enable universities to focus on rejuvenating the infrastructure of the U.S. food and agricultural sciences higher education system by revitalizing curricula, reinvigorating faculty, improving participation of women and minority students in higher education, utilizing new technologies to optimize learning, enriching undergraduate research, and recruiting academically talented students. It brings much-needed closer working relationships between USDA, the Nation's universities, the States, and the private sector.

Nature of Change. Higher Education programs across the country will be enhanced by utilizing innovative technologies to maximize learning; providing for curriculum and faculty development, especially in the international arena; and ensuring greater representation of all cultural groups. One example is sponsorship of further courses taught via the national video network, AG*SAT, to enhance course offerings by the best instructors on topics where faculty are in limited supply and to disseminate them widely.

(c) An increase of $1,000,000 for the Minority Scholars Program (No funding available in 1993).

Need for Change. The most pervasive problem of the American educational system remains the insufficient educational preparation of minority students, especially those who are economically deprived. The Federal government, as the most important force outside the university itself, must promote a comprehensive, long-range agenda to incorporate the recruitment and training of minority college and university students at the undergraduate level. A new USDA Minority Scholars Program is proposed specifically to attract and educate more minorities for careers as agriscience and agribusiness professionals. The purposes of the program are to increase the ethnic and cultural diversity of the food and agricultural scientific and professional work force and to advance the educational achievement of minority Americans.

Nature of Change. This department-wide initiative will be open to all U.S. colleges and universities with baccalaureate and higher degree programs in Agriculture, Forestry and Natural Resources, Home Economics, Veterinary Medicine, and closely allied fields. It will require 25 percent non-Federal matching support, thereby creating partnerships with the State and

private sectors. Federal funds will provide three years of scholarship support; the college or university will provide a fourth year of support. The increase requested will initiate a program to support the recruitment of and training for four years of almost 50 new baccalaureate minority scholars in the food and agricultural sciences. Once accepted for support under the program, the minority scholars will be assigned to all interested USDA agencies for special mentoring opportunities.

After the program has operated for a period of time which allows collecting and analyzing a reasonable set of data (captured on student appointment forms and exit forms), it will be evaluated. Characteristics of minority scholars supported under the program will be analyzed with regard to race/ethnicity, gender, academic performance, honors received during college, and future career plans. The purpose of the evaluation will be to provide baseline information for increasing the impact of the Minority Scholars Program with regard to strengthening the participation of all minorities in the food and agricultural sciences.

COOPERATIVE STATE RESEARCH SERVICE

INVESTMENT PROPOSALS

Base Request, 1994	$392,407,000
Total Request, 1994	431,407,000
Investment Proposals	+39,000,000

SUMMARY OF INCREASES AND DECREASES - INVESTMENT PROPOSALS

Item of Change	1994 Base Request	Investment Proposals	1994 Total Request
Payments under the Hatch Act ...	$173,451,000	- -	$173,451,000
Cooperative forestry research ..	19,045,000	+$9,000,000	28,045,000
Payments to 1890 colleges and Tuskegee University	28,157,000	- -	28,157,000
Special research grants	48,929,000	- -	48,929,000
National Research Initiative competitive grants	100,195,000	+30,000,000	130,195,000
Federal administration (direct appropriation)	13,641,000	- -	13,641,000
Higher education:			
Morrill-Nelson	2,850,000	- -	2,850,000
Other	6,139,000	- -	6,139,000
Total Available	392,407,000	+39,000,000	431,407,000

Cooperative State Research Service
Summary of Investment Proposals

SUMMARY OF INCREASES AND DECREASES - INVESTMENT PROPOSALS

Item of Change	1994 Base Request	1994 Investment Proposals	1994 Total Request
Payments under the Hatch Act ...	$173,451,000	- -	$173,451,000
Cooperative forestry research ..	19,045,000	+$9,000,000	28,045,000
Payments to 1890 colleges and Tuskegee University	28,157,000	- -	28,157,000
Special research grants	48,929,000	- -	48,929,000
National research initiative competitive grants	100,195,000	+30,000,000	130,195,000
Federal administration (direct appropriation)	13,641,000	- -	13,641,000
Higher education:			
Morrill-Nelson	2,850,000	- -	2,850,000
Other	6,139,000	- -	6,139,000
Total available	392,407,000	+39,000,000	431,407,000

Explanation of Investment Proposals

An increase of $9,000,000 for the Cooperative Forestry Research program.

This investment of $9 million for the USDA Forestry Research Initiative will allow CSRS to distribute funds to eligible institutions for the purpose of conducting regional forest ecosystem research. This initiative is being carried out in cooperation with Forest Service and Extension Service. Information will be obtained to help the Nation develop sound forest-related policies that will both provide resources to meet ever-increasing demands from the population and sustain forest ecosystems.

Managing the Nation's forest resources relies upon scientific information and technology. Responsible environmental management requires a much more thorough understanding of forest ecosystem structure and dynamics, landscape-level ecology, biological diversity, alternative silvicultural systems, and intensive management for wood production. This investment will permit the forestry schools and other cooperating institutions participating in the Cooperative Forestry Research program (McIntire-Stennis) to increase the breadth and depth of the Nation's critically important forestry research. Results of this research will provide information necessary to help the Nation develop sound forest-related policies. These policies will help ensure the provision of resources to meet the ever-increasing demands from our growing population while sustaining forest ecosystems.

Additional investments in forestry research are needed in order to prevent the Nation from jeopardizing its economic and environmental future. With additional research, forest management offers the best opportunity for integrating sustainable development with environmental protection. In addition to the research needs there is a parallel need for a new pool of scientists who have been educated to think in terms of these macro-level concepts. The Cooperative Forestry Research Program has this as a goal.

Program emphasis will focus upon ecosystem research which will be designed to understand natural ecological processes. With improved understanding of ecological processes it will be possible to restore and sustain ecosystems using advances in ecological management practices. Further, U. S. forest management may be reformed to better address economic and environmental concerns. Research programs will be designed in cooperation with the forestry schools, the Forest Service, and the Extension Service. This will enhance integration of research planning and encourage timely transfer of new technology, synthesis of research information, and the application of science to ecosystem management.

An increase of $30,000,000 for the National Research Initiative Competitive Grants program.

The National Research Initiative (NRI) supports research to assure the continued competitiveness of U.S. agricultural products in global trade, ensure the food supply's safety and quality, and sustain natural resources. This $30 million investment will provide for a total program of $130,195,000 in 1994 and will fund research in the six NRI categories including such areas as animal and plant biotechnology, food safety, sustainable agricultural production practices, and technologies to manufacture new agricultural materials. Since the NRI program focuses primarily on basic research, the results of many projects will be useful to scientists in other disciplines. The total NRI request of $130,195,000 is distributed among the six NRI categories as follows:

NRI Categories	1994 Request
Natural resources and the environment	$26,000,000
Nutrition, food quality, and health	13,000,000
Plant systems	45,195,000
Animal systems	30,000,000
Processing for value-added products	9,000,000
Rural development, markets, and trade	7,000,000
Total	130,195,000

To the extent that funds are awarded competitively and not earmarked for specific sites or institutions, it is proposed that funding for the NRI investment be increased by $70 million in 1995 and $50 million annually thereafter.

Proposed Language

In addition to funding already available under this heading, and subject to the same terms and conditions, $9,000,000 for grants for regional forest ecosystem research under the Act approved October 10, 1962 (16 U.S.C. 582a-582-a7), as amended, including administrative expenses, and payments under section 1361(c) of the Act of October 3, 1980 (7 U.S.C. 301n.); and $30,000,000 for competitive research grants under section 2(b) of the Act of August 4, 1965, as amended (7 U.S.C. 450i(b)), including administrative expenses.

SMALL BUSINESS INNOVATION RESEARCH PROGRAM

The Small Business Innovation Development Act (SBIR), Public Law 97-219, July 22, 1982, as amended by Public Law 99-443, October 6, 1986, was designed to strengthen the role of small, innovative firms in Federally funded research and development. Under this program small firms receive at least a fixed minimum percentage of research and development awards made by Federal agencies with sizable research and development budgets. From FY 1986 through FY 1992, 1.25 percent of an agency's extramural research budget was set aside for purposes of the SBIR Act. The Small Business Research and Development Enhancement Act of 1992 (Public Law 102-564, October 28, 1992) has amended the set-aside percent for the SBIR program as follows: 1.5 percent in fiscal years 1993 and 1994, 2.0 percent in fiscal years 1995 and 1996, and 2.5 percent in each fiscal year thereafter.

Agency	FY 1992 Actual	FY 1993 Estimate	FY 1994 Estimate
Agricultural Research Service	$397,751	$486,595	$486,595
Agricultural Marketing Service	15,625	- -	- -
Alternative Agricultural Research and Commercialization	47,812	92,438	255,000
Cooperative State Research Service	5,034,828	6,045,841	6,010,210
Economic Research Service	21,250	15,000	12,000
Forest Service	60,750	444,000	375,000
Human Nutrition Information Service	43,575	6,630	37,245
National Agricultural Statistics Service	2,312	2,400	2,400
Office of International Cooperation and Development	3,600	2,393	2,393
Total	5,627,503	7,095,297	7,180,843

The functions of the SBIR program (solicitation, review and evaluation of proposals) have been centralized in order to most effectively and efficiently serve the SBIR community. Eight research topic areas have been established:

1. Forests and Related Resources. Research proposals are solicited to develop environmentally sound techniques to increase productivity of forest land and to increase the utilization of materials and resources from forest lands.

2. Plant Production and Protection. Research proposals are solicited to examine means of enhancing crop production by reducing the impact of destructive agents, developing effective crop systems that are economically and environmentally sound, enhancing the impact of new methods of plant manipulation, and developing new crop plants and new uses for existing crops.

3. Animal Production and Protection. Research proposals are solicited to find ways to enable producers of food animals to increase production efficiency and to assure a reliable and safe supply of animal protein and other animal products while conserving resources and reducing production costs.

4. Air, Water and Soils. Research proposals are solicited to develop technologies for conserving air, water and soil resources while sustaining agricultural productivity.

5. Food Science and Nutrition. Research proposals are solicited to develop new knowledge and a better understanding of the characteristics of foods and their nutritional impact; to apply new knowledge to improve our foods and diets; and to apply new knowledge to the production of useful new food products, processes, materials, and systems including application of nutritional information to consumer foods and food service systems.

6. Rural and Community Development. Research proposals are solicited to promote, foster, or improve the well-being of rural Americans.

7. Aquaculture. Research proposals are solicited to enhance the knowledge and technology base necessary for the continued growth of the domestic aquaculture industry as a form of production agriculture. Emphasis is placed on research leading to improved production efficiency and increased competitiveness of private sector aquaculture in the United States.

8. Industrial Applications. Research proposals are solicited to develop new or improved technologies that will lead to increased production of industrial products from agricultural materials.

TABLE 1
DISTRIBUTION OF CSRS FEDERAL PAYMENTS FOR RESEARCH AND EDUCATION AT STATE AGRICULTURAL EXPERIMENT STATIONS AND OTHER STATE INSTITUTIONS - FISCAL YEAR 1992

STATE	HATCH ACT AS AMENDED REGULAR FORMULA	HATCH ACT AS AMENDED REGIONAL PROGRAM	HATCH ACT AS AMENDED TOTAL	COOPERATIVE FORESTRY RESEARCH (MS)	1890 COLLEGES & TUSKEGEE UNIV. (EA)	ANIMAL HEALTH & DISEASE RESEARCH	SPECIAL RESEARCH GRANTS	NRI COMPETITIVE GRANTS	HIGHER EDUCATION GRANTS	FEDERAL ADMIN. DIRECT APPROP.	FACILITIES	BIOTECH RISK ASSESS.	TOTAL FEDERAL FUNDS
ALABAMA	2,832,280	789,521	3,621,801	600,994	3,041,743	116,498	794,432	792,380	50,000	1,975,214	0	108,695	11,101,757
ALASKA	769,750	134,732	904,482	358,939	0	6,052	5,000	18,759	50,000	0	0	0	1,343,232
AMERICAN SAMOA	640,453	20,000	660,453	0	0	0	0	0	50,000	0	0	0	710,453
ARIZONA	1,064,749	712,403	1,777,152	255,202	0	54,046	379,621	2,826,307	50,000	0	97,000	0	5,439,328
ARKANSAS	2,443,851	691,939	3,135,790	508,782	1,342,586	83,430	2,783,982	626,252	50,000	401,522	3,686,000	0	12,618,344
CALIFORNIA	3,222,566	1,483,279	4,705,845	554,887	0	411,848	4,095,318	11,647,363	212,000	0	0	0	21,627,261
COLORADO	1,443,304	1,018,389	2,461,693	266,728	0	298,410	2,555,054	1,907,743	158,000	0	0	0	7,647,628
CONNECTICUT	1,206,750	466,386	1,673,136	186,044	0	18,916	491,676	933,088	50,000	0	0	0	3,352,860
DELAWARE	834,346	348,873	1,183,219	93,833	519,671	20,912	5,000	250,000	212,000	240,694	0	0	2,525,329
DIST. OF COLUMBIA	397,263	100,723	497,986	0	0	0	10,000	314,091	50,000	0	0	0	872,077
FLORIDA	2,042,554	627,625	2,670,179	531,836	1,103,603	139,129	2,036,470	2,715,065	376,149	987,607	814,800	0	11,374,837
GEORGIA	3,186,503	1,128,000	4,314,503	612,520	1,706,168	144,847	1,918,498	3,107,553	173,306	565,500	2,484,170	0	15,027,065
GUAM	665,942	115,365	781,307	0	0	0	279,163	0	50,000	0	0	0	1,110,470
HAWAII	824,805	361,254	1,186,059	128,412	0	7,185	2,907,034	516,754	113,956	2,504,802	3,726,740	0	11,090,942
IDAHO	1,358,163	561,669	1,919,832	405,045	0	47,612	1,291,671	494,935	50,000	0	0	0	4,209,095
ILLINOIS	4,062,087	948,732	5,010,819	312,834	0	136,879	810,705	4,802,910	501,910	718,406	2,509,390	111,000	14,914,853
INDIANA	3,720,261	799,590	4,519,851	324,360	0	90,898	2,886,610	2,365,470	385,608	0	2,667,500	0	13,240,297
IOWA	3,898,938	1,471,753	5,370,691	197,570	0	256,371	5,751,137	2,259,465	266,000	718,406	0	0	14,819,640
KANSAS	2,367,827	735,121	3,102,948	162,991	0	185,999	1,430,598	1,280,000	279,133	0	1,522,900	0	7,964,569
KENTUCKY	3,741,485	790,630	4,532,115	381,992	1,966,458	83,059	596,716	944,174	110,254	328,000	0	0	8,942,768
LOUISIANA	2,256,089	653,128	2,909,217	520,309	1,221,624	104,772	2,557,391	772,880	50,000	202,500	0	0	8,338,693
MAINE	1,183,356	486,088	1,669,444	543,362	0	19,874	673,477	533,084	50,000	0	145,500	0	3,634,741
MARYLAND	1,633,289	611,624	2,244,913	220,623	898,843	38,381	505,595	1,506,163	113,952	452,439	970,000	0	6,950,909
MASSACHUSETTS	1,426,328	601,124	2,027,452	232,149	0	34,751	1,251,189	1,831,505	101,386	0	0	0	5,478,432
MICHIGAN	3,734,226	841,927	4,576,153	497,256	0	82,970	6,364,986	3,337,180	222,000	0	4,923,720	112,500	20,116,765
MICRONESIA	340,868	0	340,868	0	0	0	0	0	50,000	0	0	0	390,868
MINNESOTA	3,656,056	897,059	4,553,115	439,624	0	178,457	1,623,868	1,730,350	414,000	0	0	0	8,939,404
MISSISSIPPI	2,916,570	798,392	3,714,962	577,941	1,558,358	75,438	3,743,585	569,024	50,000	2,357,514	0	0	12,646,822
MISSOURI	3,536,320	749,554	4,285,874	347,413	1,874,258	158,625	1,813,727	3,003,697	360,000	597,863	140,650	104,962	12,687,069
MONTANA	1,281,143	629,036	1,910,179	393,519	0	70,217	468,300	907,287	50,000	0	1,030,140	0	4,829,642
NEBRASKA	2,193,999	850,587	3,044,586	139,938	0	193,214	3,133,973	1,175,414	212,000	0	4,365,000	0	12,264,125
NEVADA	762,880	344,412	1,107,292	59,253	0	25,377	194,332	0	50,000	0	242,500	0	1,678,754
NEW HAMPSHIRE	960,058	349,603	1,309,661	301,307	0	9,657	101,000	384,111	50,000	0	0	0	2,155,736
NEW JERSEY	1,402,657	1,162,919	2,565,576	174,517	0	22,347	1,324,447	1,606,900	50,000	0	2,952,680	0	8,696,467
NEW MEXICO	1,096,980	378,938	1,475,918	209,096	0	38,605	1,225,064	459,875	90,000	0	0	0	3,498,558
NEW YORK	3,566,542	1,443,665	5,010,207	589,467	0	263,560	2,634,842	5,638,345	569,145	0	1,673,250	32,554	16,411,370
NORTH CAROLINA	4,810,480	1,132,166	5,942,646	566,414	2,456,351	105,868	812,867	3,479,298	104,000	602,278	3,176,750	0	17,246,472
NORTH DAKOTA	1,619,177	564,813	2,183,990	70,780	0	52,878	2,893,836	472,224	50,000	1,101,557	4,977,070	0	11,802,335
NORTHERN MARIANAS	434,869	0	434,869	0	0	0	0	0	50,000	0	0	0	484,869

TABLE 1
DISTRIBUTION OF CSRS FEDERAL PAYMENTS FOR RESEARCH AND EDUCATION AT STATE AGRICULTURAL EXPERIMENT STATIONS AND OTHER STATE INSTITUTIONS - FISCAL YEAR 1992

STATE	HATCH ACT AS AMENDED: REGULAR FORMULA	HATCH ACT AS AMENDED: REGIONAL PROGRAM	HATCH ACT AS AMENDED: TOTAL	COOPERATIVE FORESTRY RESEARCH (MS)	1890 COLLEGES & TUSKEGEE UNIV. (EA)	ANIMAL HEALTH & DISEASE RESEARCH	SPECIAL RESEARCH GRANTS	NRI COMPETITIVE GRANTS	HIGHER EDUCATION GRANTS	FEDERAL ADMIN. DIRECT APPROP.	FACILITIES	BIOTECH RISK ASSESS.	TOTAL FEDERAL FUNDS
OHIO	4,432,560	909,281	5,341,841	335,887	0	117,725	1,638,445	2,280,823	437,958	0	0	0	10,152,679
OKLAHOMA	2,255,251	567,746	2,822,997	289,781	1,247,973	134,025	951,489	1,086,159	50,000	987,607	218,250	0	7,788,281
OREGON	1,695,983	890,924	2,586,907	635,573	0	91,561	3,769,374	2,507,029	50,000	0	210,490	0	9,850,934
PENNSYLVANIA	4,391,007	1,190,363	5,581,370	451,151	0	144,191	2,379,148	1,820,970	115,480	0	0	0	10,492,310
PUERTO RICO	3,094,534	703,028	3,797,562	82,306	0	13,178	332,150	0	50,000	0	0	0	4,275,196
RHODE ISLAND	764,650	362,011	1,126,661	105,359	0	6,771	166,027	283,896	50,000	0	485,000	0	2,223,714
SOUTH CAROLINA	2,460,903	652,022	3,112,925	462,677	1,321,658	25,120	606,891	847,383	50,000	517,157	0	115,000	7,058,811
SOUTH DAKOTA	1,666,815	569,623	2,236,438	116,885	0	98,550	82,270	656,879	50,000	0	1,469,550	0	4,710,572
TENNESSEE	3,570,882	808,373	4,379,255	416,571	1,869,725	64,763	137,911	1,737,913	50,000	769,848	1,310,470	0	10,736,456
TEXAS	4,660,105	1,149,907	5,810,012	474,204	2,455,777	404,473	2,117,131	5,369,090	158,883	566,496	3,744,200	0	21,100,266
UTAH	963,550	649,244	1,612,794	151,464	0	52,649	138,446	1,213,500	50,000	0	741,080	0	3,959,933
VERMONT	1,014,969	306,543	1,321,512	278,255	0	14,023	1,852,478	389,812	111,360	0	0	0	3,967,440
VIRGIN ISLANDS	651,907	113,106	765,013	47,727	0	0	213,946	0	50,000	0	0	0	1,076,686
VIRGINIA	3,047,328	739,622	3,786,950	485,730	1,607,222	93,987	326,196	844,165	158,000	1,717,418	990,370	0	10,010,038
WASHINGTON	1,932,358	1,365,808	3,298,166	624,046	0	176,379	3,653,884	1,839,200	50,000	0	2,056,400	0	11,698,075
WEST VIRGINIA	1,924,626	509,444	2,434,070	370,466	0	11,967	44,999	444,387	50,000	0	0	0	3,355,889
WISCONSIN	3,664,951	946,180	4,611,131	428,098	0	183,596	623,176	5,246,535	193,520	0	7,171,210	4,289	18,461,555
WYOMING	906,381	501,883	1,408,264	220,623	0	37,591	28,680	360,963	50,000	0	485,000	0	2,591,121
OTHER	0	215,700	215,700	0	38,100	0	435,309	0	0	0	0	0	689,109
SBIR	1,555,934	493,529	2,049,463	224,713	332,225	66,612	1,037,222	1,170,000	0	154,593	0	0	5,034,828
SUBTOTAL	124,190,458	39,445,356	163,635,814	17,967,452	26,562,343	5,314,243	82,886,326	93,308,350	7,700,000	18,467,421	60,987,780	589,000	477,418,729
UNOBLIGATED BAL.	167,778	0	167,778	0	0	0	0	0	0	0	16,462,840		16,630,618
SUBTOTAL	124,358,236	39,445,356	163,803,592	17,967,452	26,562,343	5,314,243	82,886,326	93,308,350	7,700,000	18,467,421	77,450,620	589,000	494,049,347
FEDERAL ADMIN.			4,827,939	555,990	822,000	222,040	3,312,014	3,900,000	150,000	2,323,290	2,041,220	0	18,154,493
UNOBLIGATED BAL.			0	0	0	0	0	0	0	0	509,160		509,160
SUBTOTAL	0	0	4,827,939	555,990	822,000	222,040	3,312,014	3,900,000	150,000	2,323,290	2,550,380	0	18,663,653
Biotech. Risk Assessment	116,512	36,957	153,469	9,558	15,657	14,717	99,660	291,650	0	4,289	0	(589,000)	0
TOTAL	124,474,748	39,482,313	168,785,000	18,533,000	27,400,000	5,551,000	86,298,000	97,500,000	7,850,000	20,795,000	80,001,000	0	512,713,000

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Table 2
Payments to State Agricultural Experiment Stations under the Hatch Act

State	FY 1992 Actual			FY 1993 Estimate			FY 1994 Estimate		
	Regular Formula	Regional Research	Total	Regular Formula	Regional Research	Total	Regular Formula	Regional Research (a)	Total
Alabama	$2,832,280	$789,521	$3,621,801	$2,814,952	$787,843	$3,602,795	$2,879,601	$787,843	3,667,444
Alaska	769,750	134,732	904,482	764,621	134,626	899,247	784,498	134,626	919,124
American Samoa	640,453	20,000	660,453	638,711	0	638,711	665,374	0	665,374
Arizona	1,064,749	712,403	1,777,152	1,057,650	711,834	1,769,484	1,084,606	711,834	1,796,440
Arkansas	2,443,851	691,939	3,135,790	2,428,373	690,468	3,118,841	2,484,657	690,468	3,175,125
California	3,222,566	1,483,279	4,705,845	3,199,837	1,437,128	4,636,965	3,303,424	1,437,128	4,740,552
Colorado	1,443,304	1,018,389	2,461,693	1,433,452	1,022,742	2,456,194	1,474,330	1,022,742	2,497,072
Connecticut	1,206,750	466,386	1,673,136	1,198,832	464,843	1,663,675	1,229,582	464,843	1,694,425
Delaware	834,346	348,873	1,183,219	828,751	347,723	1,176,474	850,269	347,723	1,197,992
Dist. of Col.	397,263	100,723	497,986	518,987	100,390	619,377	535,111	100,390	635,501
Florida	2,042,554	627,625	2,670,179	2,027,245	626,291	2,653,536	2,095,252	626,291	2,721,543
Georgia	3,186,503	1,128,000	4,314,503	3,165,037	1,090,039	4,255,076	3,250,807	1,090,039	4,340,846
Guam	665,942	115,365	781,307	661,432	115,274	776,706	678,827	115,274	794,101
Hawaii	824,805	361,254	1,186,059	819,570	360,966	1,180,536	839,931	360,966	1,200,897
Idaho	1,358,163	561,669	1,919,832	1,348,652	561,221	1,909,873	1,386,600	561,221	1,947,821
Illinois	4,062,087	948,732	5,010,819	4,034,041	947,540	4,981,581	4,146,766	947,540	5,094,306
Indiana	3,720,261	799,590	4,519,851	3,693,795	798,586	4,492,381	3,804,248	798,586	4,602,834
Iowa	3,898,938	1,471,753	5,370,691	3,870,819	1,486,442	5,357,261	3,985,952	1,486,442	5,472,394
Kansas	2,367,827	735,121	3,102,948	2,351,462	734,199	3,085,661	2,415,081	734,199	3,149,280
Kentucky	3,741,485	790,630	4,532,115	3,716,401	788,950	4,505,351	3,819,366	788,950	4,608,316
Louisiana	2,256,089	653,128	2,909,217	2,241,908	651,739	2,893,647	2,295,879	651,739	2,947,618
Maine	1,183,356	486,088	1,669,444	1,175,315	484,484	1,659,799	1,207,715	484,484	1,692,199
Maryland	1,633,289	611,624	2,244,913	1,622,488	609,604	2,232,092	1,665,518	609,604	2,275,122
Massachusetts	1,426,328	601,124	2,027,452	1,417,017	595,055	2,012,072	1,453,977	595,055	2,049,032
Michigan	3,734,226	841,927	4,576,153	3,708,550	840,869	4,549,419	3,813,451	840,869	4,654,320
Micronesia	340,868	0	340,868	672,666	0	672,666	691,358	0	691,358
Minnesota	3,656,056	897,059	4,553,115	3,630,295	837,987	4,468,282	3,734,881	837,987	4,572,868
Mississippi	2,916,570	798,392	3,714,962	2,899,762	796,694	3,696,456	2,958,935	796,694	3,755,629
Missouri	3,536,320	749,554	4,285,874	3,511,125	748,615	4,259,740	3,612,579	748,615	4,361,194
Montana	1,281,143	629,036	1,910,179	1,272,306	628,533	1,900,839	1,309,575	628,533	1,938,108
Nebraska	2,193,999	850,587	3,044,586	2,178,585	849,519	3,028,104	2,240,740	849,519	3,090,259
Nevada	762,880	344,412	1,107,292	757,731	344,136	1,101,867	777,997	344,136	1,122,133
New Hampshire	960,058	349,603	1,309,661	953,226	348,450	1,301,676	981,374	348,450	1,329,824
New Jersey	1,402,657	1,162,919	2,565,576	1,393,480	1,186,563	2,580,043	1,430,451	1,186,563	2,617,014
New Mexico	1,096,980	378,938	1,475,918	1,089,734	378,636	1,468,370	1,118,240	378,636	1,496,876
New York	3,566,542	1,443,665	5,010,207	3,542,749	1,439,356	4,982,105	3,637,646	1,439,356	5,077,002
North Carolina	4,810,480	1,132,166	5,942,646	4,780,023	1,129,758	5,909,781	4,894,292	1,129,758	6,024,050
North Dakota	1,619,177	564,813	2,183,990	1,608,252	564,105	2,172,357	1,648,437	564,105	2,212,542
N. Marianas	434,869	0	434,869	625,550	0	625,550	642,146	0	642,146
Ohio	4,432,560	909,281	5,341,841	4,401,919	908,141	5,310,060	4,532,025	908,141	5,440,166
Oklahoma	2,255,251	567,746	2,822,997	2,239,819	566,539	2,806,358	2,300,533	566,539	2,867,072
Oregon	1,695,983	890,924	2,586,907	1,684,146	890,214	2,574,360	1,737,161	890,214	2,627,375
Pennsylvania	4,391,007	1,190,363	5,581,370	4,361,506	1,186,571	5,548,077	4,483,495	1,186,571	5,670,066
Puerto Rico	3,094,534	703,028	3,797,562	3,079,509	701,534	3,781,043	3,127,798	701,534	3,829,332
Rhode Island	764,650	362,011	1,126,661	759,633	360,815	1,120,448	778,765	360,815	1,139,580
South Carolina	2,460,903	652,022	3,112,925	2,445,685	650,634	3,096,319	2,506,663	650,634	3,157,297
South Dakota	1,666,815	569,623	2,236,438	1,655,348	568,910	2,224,258	1,701,315	568,910	2,270,225
Tennessee	3,570,882	808,373	4,379,255	3,548,007	806,654	4,354,661	3,634,430	806,654	4,441,084
Texas	4,660,105	1,149,907	5,810,012	4,627,422	1,147,461	5,774,883	4,765,874	1,147,461	5,913,335
Utah	963,550	649,244	1,612,794	957,232	648,726	1,605,958	981,174	648,726	1,629,900
Vermont	1,014,969	306,543	1,321,512	1,008,084	305,531	1,313,615	1,035,060	305,531	1,340,591
Virgin Islands	651,907	113,106	765,013	647,452	112,866	760,318	664,730	112,866	777,596
Virginia	3,047,328	739,622	3,786,950	3,027,829	738,048	3,765,877	3,104,501	738,048	3,842,549
Washington	1,932,358	1,365,808	3,298,166	1,918,913	1,373,209	3,292,122	1,975,226	1,373,209	3,348,435
West Virginia	1,924,626	509,444	2,434,070	1,912,833	507,760	2,420,593	1,957,963	507,760	2,465,723
Wisconsin	3,664,951	946,180	4,611,131	3,639,169	948,867	4,588,036	3,746,828	948,867	4,695,695
Wyoming	906,381	501,883	1,408,264	900,367	501,482	1,401,849	924,368	501,482	1,425,850
Other	0	215,700	215,700	0	215,700	215,700	0	215,700	215,700
SUBTOTAL	122,634,524	38,951,827	161,586,351	122,468,255	38,780,870	161,249,125	125,777,382	38,780,870	164,558,252
Federal Admin.	0	0	4,827,939	0	0	4,827,939	0	0	4,967,919
Unoblig. Bal.	167,778	0	167,778	0	0	0	0	0	0
SBIR set-aside.	1,555,934	493,529	2,049,463	1,867,121	592,235	2,459,356	1,917,514	609,732	2,527,246
Biotech. Risk Assessment	116,512	36,957	153,469	139,372	44,208	183,580	139,372	44,208	183,580
Contingency	0	0	0	0	65,000	65,000	0	1,214,003	1,214,003
TOTAL	124,474,748	39,482,313	168,785,000	124,474,748	39,482,313	168,785,000	127,834,268	40,648,813	173,451,000

(a) Final distribution will be determined at a later date by a statutory committee authorized in the Hatch Act.

Table 3
Distribution of Funds under the McIntire-Stennis Cooperative Forestry Research Act
(In Dollars)

State/Recipient	Fiscal Year 1992 Actual	Fiscal Year 1993 Estimate	Fiscal Year 1994 Estimate
ALABAMA			
Agricultural Experiment Station, Auburn University	$600,994	$585,928	$797,501
ALASKA			
Agricultural Experiment Station, University of Alaska	358,939	356,819	482,037
AMERICAN SAMOA			
American Samoa Community College	0	0	0
ARIZONA			
Agricultural Experiment Station, University of Arizona	127,601	126,860	170,039
School of Forestry, Northern Arizona University	127,601	126,860	170,039
ARKANSAS			
Agricultural Experiment Station, Univ. of Arkansas	508,782	482,829	655,542
CALIFORNIA			
Agricultural Experiment Station, Univ. of California	443,910	441,249	600,145
Department of Forestry, California State Univ., Humboldt	83,233	82,734	112,527
California Polytechnic State University	27,744	[illegible]	37,509
COLORADO			
College of Forestry and Natural Resources, Colorado State Univ.	266,728	265,175	355,852
CONNECTICUT			
Agricultural Experiment Station, New Haven	139,533	155,923	207,738
Agricultural Experiment Station, Univ. of Connecticut, Storrs .	46,511	51,974	69,246
DELAWARE			
Agricultural Experiment Station, University of Delaware	93,833	93,343	119,254
FLORIDA			
Agricultural Experiment Station, University of Florida	531,835	494,284	671,316
GEORGIA			
School of Forest Resources, University of Georgia	612,520	608,839	829,047
GUAM			
Agricultural Experiment Station, University of Guam	0	36,066	40,388
HAWAII			
Agricultural Experiment Station, University of Hawaii	128,412	127,710	166,573
IDAHO			
College of Forestry, University of Idaho	405,045	402,641	545,130
ILLINOIS			
Agricultural Experiment Station, University of Illinois	156,417	155,498	209,472
Department of Forestry, Southern Illinois University	156,417	155,498	209,472
INDIANA			
Agricultural Experiment Station, Purdue University	324,360	322,452	434,718
IOWA			
Agriculture & Home Economics Experiment Sta., Iowa State Univ.	197,570	196,442	261,212
KANSAS			
Agricultural Experiment Station, Kansas State University	162,991	162,076	213,893
KENTUCKY			
Agricultural Experiment Station, University of Kentucky	381,992	368,274	497,810
LOUISIANA			
Agricultural Experiment Station, Louisiana State University ...	364,216	370,055	503,045
School of Forestry, Louisiana Tech University	156,093	158,595	215,591
MAINE			
Agricultural Experiment Station, University of Maine	543,362	540,106	734,408
MARYLAND			
Agricultural Experiment Station, University of Maryland	220,623	242,264	324,305
MASSACHUSETTS			
Agricultural Experiment Station, University of Massachusetts ..	232,149	230,809	308,532

State/Recipient	Fiscal Year 1992 Actual	Fiscal Year 1993 Estimate	Fiscal Year 1994 Estimate
MICHIGAN			
Agricultural Experiment Station, Michigan State University	$165,752	$168,580	$229,029
School of Natural Resources, University of Michigan	165,752	168,580	$229,029
Department of Forestry, Michigan Technological University	165,752	168,580	$229,029
MICRONESIA			
College of Micronesia	0	0	0
MINNESOTA			
Agricultural Experiment Station, University of Minnesota	439,624	437,007	592,450
MISSISSIPPI			
School of Forest Resources, Mississippi State University	577,941	574,472	781,728
MISSOURI			
Agricultural Experiment Station, University of Missouri	347,413	345,363	466,264
MONTANA			
School of Forestry, University of Montana	393,519	391,185	529,357
NEBRASKA			
Agricultural Experiment Station, University of Nebraska	139,938	139,165	182,346
NEVADA			
Agricultural Experiment Station, University of Nevada	59,253	58,977	71,934
NEW HAMPSHIRE			
Agricultural Experiment Station, University of New Hampshire ..	301,307	288,086	387,398
NEW JERSEY			
Agricultural Experiment Station, Rutgers University	174,517	173,532	229,666
NEW MEXICO			
Agricultural Experiment Station, New Mexico State University ..	209,096	219,353	292,759
NEW YORK			
Agricultural Experiment Station, Cornell University	147,367	149,346	203,319
College of Environmental Science and Forestry, State University of New York	442,100	448,037	609,956
NORTH CAROLINA			
School of Forest Resources, North Carolina State University ...	566,414	563,017	765,955
NORTH DAKOTA			
Agricultural Experiment Station, North Dakota State University	70,780	70,433	87,707
OHIO			
Agricultural Experiment Station, Ohio State University	335,887	333,908	450,491
OKLAHOMA			
Agricultural Experiment Station, Oklahoma State University	289,781	299,542	403,171
OREGON			
School of Forestry, Oregon State University	635,573	631,749	860,594
PENNSYLVANIA			
Agricultural Experiment Station, Pennsylvania State University	451,151	448,462	608,223
PUERTO RICO			
Agricultural Experiment Station, University of Puerto Rico	82,306	81,888	103,480
RHODE ISLAND			
Agricultural Experiment Station, University of Rhode Island ...	105,359	116,254	150,800
SOUTH CAROLINA			
College of Forest and Recreation Resources, Clemson University	462,677	459,918	623,996
SOUTH DAKOTA			
Agricultural Experiment Station, South Dakota State University	116,885	104,799	135,027
TENNESSEE			
Agricultural Experiment Station, University of Tennessee	416,571	414,096	560,903
TEXAS			
Agricultural Experiment Station, Texas A&M University	237,102	235,687	319,885
School of Forestry, Stephen F. Austin State University	237,102	235,687	319,885
UTAH			
College of Natural Resources, Utah State University	151,464	150,621	198,120
VERMONT			
School of Natural Resources, University of Vermont	278,255	276,631	371,625
VIRGIN ISLANDS			
Agricultural Experiment Station, Univ. of the Virgin Islands ..	47,727	47,522	56,161

State/Recipient	Fiscal Year 1992 Actual	Fiscal Year 1993 Estimate	Fiscal Year 1994 Estimate
VIRGINIA			
School of Forestry and Wildlife Resources, Virginia Polytechnic Institute and State University	$485,730	$517,195	$702,862
WASHINGTON			
Agricultural Experiment Station, Washington State University	280,821	279,132	464,651
College of Forest Resources, University of Washington	343,225	341,162	380,169
WEST VIRGINIA			
Agricultural Experiment Station, West Virginia University	370,466	379,730	513,584
WISCONSIN			
Agricultural Experiment Station, University of Wisconsin	428,098	425,551	576,676
WYOMING			
Agricultural Experiment Station, University of Wyoming	220,623	184,987	245,439
Subtotal	17,742,739	17,697,115	23,876,009
Federal administration (3%)	555,990	555,990	841,350
Small Business Act	224,713	269,655	408,055
Biotechnology Risk Assessment	9,558	10,240	10,240
Regional forest ecosystem research	0	0	2,909,346
Total	18,533,000	18,533,000	28,045,000

Table 4

Evans-Allen Payments to 1890 Colleges and Tuskegee University
Under Section 1445, Public Law 95-113, As Amended
(In Dollars)

State/Institution	Fiscal Year 1992 Actual	Fiscal Year 1993 Estimate	Fiscal Year 1994 Estimate
ALABAMA			
Alabama A&M University	$1,530,581	$1,526,433	$1,562,990
Tuskegee University	1,511,162	1,507,067	1,543,624
ARKANSAS			
University of Arkansas--Pine Bluff..	1,342,586	1,338,947	1,371,360
DELAWARE			
Delaware State College	519,671	518,262	529,892
FLORIDA			
Florida A&M University	1,103,603	1,100,611	1,138,377
GEORGIA			
Fort Valley State College	1,706,168	1,701,544	1,750,123
KENTUCKY			
Kentucky State University	1,966,458	1,961,127	2,022,523
LOUISIANA			
Southern University	1,221,624	1,218,314	1,248,444
MARYLAND			
University of Maryland-Eastern Shore	898,843	896,407	920,433
MISSISSIPPI			
Alcorn State University	1,874,258	1,869,177	1,930,224
MISSOURI			
Lincoln University	1,558,358	1,554,136	1,587,685
NORTH CAROLINA			
North Carolina A&T State University.	2,456,351	2,449,694	2,514,914
OKLAHOMA			
Langston University	1,247,973	1,244,590	1,280,090
SOUTH CAROLINA			
South Carolina State College........	1,321,658	1,318,077	1,352,125
TENNESSEE			
Tennessee State University	1,869,725	1,864,658	1,914,928
TEXAS			
Prairie View A&M College	2,455,777	2,449,119	2,529,978
VIRGINIA			
Virginia State College	1,607,222	1,602,867	1,646,596
CRIS	38,100	38,100	38,100
Subtotal	26,230,118	26,159,130	26,882,406
Federal Administration (3%)	822,000	822,000	844,710
Small Business Set-Aside	332,225	398,670	409,684
Biotechnology Risk Assessment	15,657	20,200	20,200
TOTAL	27,400,000	27,400,000	28,157,000

Table 5
Distribution of Funds for Animal Health and Disease Research
Section 1433, P.L. 95-113
(In Dollars)

State/Recipient	Fiscal Year 1992 Actual	Fiscal Year 1993 Est.
ALABAMA		
Agricultural Experiment Station, Auburn University	$45,581	$45,786
School of Veterinary Medicine, Auburn University	67,046	68,300
School of Veterinary Medicine, Tuskegee University	3,871	1,968
ALASKA		
Agricultural Experiment Station, University of Alaska	6,052	6,778
ARIZONA		
Agricultural Experiment Station, University of Arizona	54,046	48,900
ARKANSAS		
Agricultural Experiment Station, University of Arkansas	83,430	83,394
CALIFORNIA		
Agricultural Experiment Station, Univ. of California, Oakland	198,130	192,383
School of Veterinary Medicine, University of California, Davis	213,718	262,861
COLORADO		
Agricultural Experiment Station and College of Veterinary Medicine, Colorado State University	298,410	304,402
CONNECTICUT		
Agricultural Experiment Station, Univ. of Connecticut, Storrs	18,916	17,969
DELAWARE		
Agricultural Experiment Station, University of Delaware	20,912	21,057
FLORIDA		
Agricultural Experiment Station, University of Florida	67,899	51,269
College of Veterinary Medicine, University of Florida	71,230	80,901
GEORGIA		
Agricultural Experiment Station, University of Georgia	21,809	19,337
College of Veterinary Medicine, University of Georgia	123,038	122,294
HAWAII		
Agricultural Experiment Station, University of Hawaii	7,185	7,466
IDAHO		
Agricultural Experiment Station, University of Idaho	47,612	48,693
ILLINOIS		
Agricultural Experiment Station and College of Veterinary Medicine, University of Illinois	136,879	149,716
INDIANA		
Agricultural Experiment Station and College of Veterinary Medicine, Purdue University	90,898	84,060
IOWA		
Agriculture & Home Economics Experiment Sta., Iowa State Univ.	45,082	42,365
College of Veterinary Medicine, Iowa State University	211,289	206,472
KANSAS		
Agricultural Experiment Station and College of Veterinary Medicine, Kansas State University	185,999	191,687
KENTUCKY		
Agricultural Experiment Station, University of Kentucky	83,059	79,247
LOUISIANA		
Agricultural Experiment Station, Louisiana State University	58,329	58,254
College of Veterinary Medicine, Louisiana State University	46,443	42,662
MAINE		
Agricultural Experiment Station, University of Maine	19,874	20,783
MARYLAND		
Agricultural Experiment Station, University of Maryland	38,381	37,758

State/Recipient	Fiscal Year 1992 Actual	Fiscal Year 1993 Est.
MASSACHUSETTS		
Agricultural Experiment Station, University of Massachusetts ..	$9,463	$11,112
School of Veterinary Medicine, Tufts University	25,288	17,927
MICHIGAN		
Agricultural Experiment Station and College of Veterinary Medicine, Michigan State University	82,970	74,654
MINNESOTA		
Agricultural Experiment Station, University of Minnesota	76,246	75,155
College of Veterinary Medicine, University of Minnesota	102,211	99,770
MISSISSIPPI		
Agricultural and Forestry Experiment Station and College of Veterinary Medicine, Mississippi State University	75,438	71,031
MISSOURI		
Agricultural Experiment Station, University of Missouri	61,237	66,236
College of Veterinary Medicine, University of Missouri	97,388	96,193
MONTANA		
Agricultural Experiment Station, Montana State University	70,217	71,143
NEBRASKA		
Agricultural Experiment Station, University of Nebraska	193,214	203,572
NEVADA		
Agricultural Experiment Station, University of Nevada	25,377	23,720
NEW HAMPSHIRE		
Agricultural Experiment Station, University of New Hampshire ..	9,657	8,588
NEW JERSEY		
Agricultural Experiment Station, Rutgers University	22,347	18,811
NEW MEXICO		
Agricultural Experiment Station, New Mexico State University ..	38,605	39,460
NEW YORK		
Agricultural Experiment Station, Cornell University	61,306	48,102
College of Veterinary Medicine, Cornell University	202,254	187,249
NORTH CAROLINA		
Agricultural Experiment Station, North Carolina State University	99,244	88,748
College of Veterinary Medicine, North Carolina State University	6,624	12,473
NORTH DAKOTA		
Agricultural Experiment Station, North Dakota State University	52,878	52,148
OHIO		
Ohio Agricultural Research and Dev. Center, Ohio State Univ. ..	79,763	72,082
College of Veterinary Medicine, Ohio State University	37,962	38,844
OKLAHOMA		
Agricultural Experiment Station and College of Veterinary Medicine, Oklahoma State University	134,025	142,627
OREGON		
Agricultural Experiment Station, Oregon State University	74,161	80,325
College of Veterinary Medicine, Oregon State University	17,400	15,690
PENNSYLVANIA		
Agricultural Experiment Station, Pennsylvania State Univ.	57,058	62,029
College of Veterinary Medicine, University of Pennsylvania	87,133	78,107
PUERTO RICO		
Agricultural Experiment Station, University of Puerto Rico	13,178	12,870
RHODE ISLAND		
Agricultural Experiment Station, University of Rhode Island ...	6,771	6,275
SOUTH CAROLINA		
Agricultural Experiment Station, Clemson University	25,120	26,051
SOUTH DAKOTA		
Agricultural Experiment Station, South Dakota State University	98,550	99,581

State/Recipient	Fiscal Year 1992 Actual	Fiscal Year 1993 Est.
TENNESSEE		
Agricultural Experiment Station and College of Veterinary Medicine, University of Tennessee	64,763	$64,278
TEXAS		
Agricultural Experiment Station and College of Veterinary Medicine, Texas A&M University	$404,473	410,628
UTAH		
Agricultural Experiment Station, Utah State University	52,649	56,858
VERMONT		
Agricultural Experiment Station, University of Vermont	14,023	13,282
VIRGINIA		
Agricultural Experiment Station and College of Veterinary Medicine, Virginia Polytechnic Institute and State Univ.	93,987	84,628
WASHINGTON		
Agricultural Experiment Station, Washington State Univ.	31,772	28,219
College of Veterinary Medicine, Washington State Univ.	144,607	146,265
WEST VIRGINIA		
Agricultural & Forestry Experiment Station, West Virginia State University	11,967	11,950
WISCONSIN		
Agricultural Experiment Station and College of Veterinary Medicine, University of Wisconsin	183,596	178,784
WYOMING		
Agricultural Experiment Station, University of Wyoming	37,591	38,629
Subtotal	5,247,631	5,230,856
Federal administration	222,040	222,040
Small Business Act	66,612	79,934
Biotechnology Risk Assessment	14,717	18,170
Total	5,551,000	5,551,000

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Table 6
National Research Initiative Competitive Grants Program
Proposals Submitted and Grants Awarded in Fiscal Year 1992

Program	Proposals Received	Dollars Requested	Grants Awarded	Dollars Awarded
NATURAL RESOURCES AND THE ENVIRONMENT				
NR-Forest/Rangeland/Crop Ecosystems	90	19,573,756	26	$3,567,243
NRICGP Water Quality	117	27,281,384	21	3,430,010
Improved Utilization of Wood & Wood Fibers	108	13,960,125	24	2,132,000
Plant Response to the Environment	189	39,869,540	52	6,978,600
Triagency Natural Resources	(a)	(a)	3	200,000
Natural Resources Strengthening	36	1,434,968	17	700,000
Subtotal	540	102,119,773	143	17,007,853
NUTRITION, FOOD QUALITY AND HEALTH				
Human Nutrition	116	32,638,518	29	3,564,147
Food Safety	69	13,232,122	16	2,216,135
Nutrition Strengthening	12	654,231	6	261,443
Subtotal	197	46,524,871	51	6,141,725
ANIMAL SYSTEMS				
Reproductive Biology	134	29,094,166	36	5,713,916
Cellular Growth/Developmental Biology	135	33,573,732	27	5,179,457
Animal Molecular Genetics	54	13,761,116	14	2,150,987
Molecular & Cellular Basis of Disease	286	68,526,758	59	9,725,520
Animal Systems Strengthening	39	1,743,655	20	852,139
Subtotal	648	146,699,427	156	23,622,019
PLANT SYSTEMS				
Alcohol Fuels	17	3,510,802	3	500,000
Nitrogen Fixation/Metabolism	76	14,830,027	34	2,940,000
PS-Forest/Rangeland/Crop Ecosystem	3	605,374	1	93,640
Pathogens	209	42,023,608	60	5,770,000
Photosynthesis	72	17,965,826	28	2,820,000
Plant Genetic Mechanisms	134	32,472,054	47	4,626,000
Plant Genome	106	30,832,527	36	6,880,000
Plant Growth & Development	188	40,252,071	55	5,560,000
Plant Pest Interactions, Insects, Nematodes	266	49,617,258	66	7,288,329
Triagency Plant Systems	(a)	(a)	2	167,240
Plant Systems Strengthening	88	3,887,657	28	1,150,021
Subtotal	1,159	235,997,204	360	37,795,230
MARKETS, TRADE AND POLICY				
Markets, Competitiveness & Technology	111	20,235,979	21	1,897,159
Rural Development	84	13,744,233	14	1,764,841
Markets Strengthening	12	563,802	3	130,000
Subtotal	207	34,544,014	38	3,792,000
PROCESSING FOR VALUE ADDED PRODUCTS				
Processing for Value Added	143	30,699,319	26	3,633,531
Processing Strengthening	17	730,298	3	145,992
Subtotal	160	31,429,617	29	3,779,523
TOTAL	2,911	597,314,906	777	92,138,350

Performing Organization	Proposals Received	Dollars Requested	Grants Awarded	Dollars Awarded
1862 Land-Grant Universities	1,539	$315,601,975	330	$41,405,925
1890 Land-Grant Universities	37	6,005,826	3	110,880
Other	30	4,673,218	5	416,100
Other Federal Research Laboratories	22	4,714,714	7	860,000
Private Non-Profit	88	23,442,544	17	1,575,939
Private Profit	13	2,311,962	2	168,000
Private Universities	122	24,252,601	48	4,985,397
Public Universities	314	78,671,036	81	10,015,849
SAES	496	86,666,473	238	26,456,625
State and Local Agencies	2	517,397	0	0
USDA Agencies	145	28,164,151	28	3,079,635
Veterinary Schools & Colleges	103	22,293,009	18	3,064,000
TOTAL	2,911	597,314,906	777	92,138,350

(a) Proposals submitted to collaborative Research in Plant Biology Program supported jointly by USDA, NSF, and DOE. Total of 66 proposals requesting $94,182,414 were submitted.

Table 7
National Research Initiative Competitive Grants
Fiscal Year 1992 Recipients
(In Dollars)

State/Recipient	Fiscal Year 1992 Actual
ALASKA	
University of Alaska, Fairbanks	$18,759
ALABAMA	
Auburn University	792,380
ARIZONA	
University of Arizona	2,187,147
Arizona State University	240,000
Northern Arizona University	399,160
ARKANSAS	
University of Arkansas	506,252
University of Arkansas for Medical Sciences, Little Rock	120,000
CALIFORNIA	
University of California, Davis	6,336,712
University of California, Berkeley	1,654,400
San Diego State University	100,000
San Francisco State University	170,167
University of California, Santa Barbara	180,000
University of California, San Diego	390,000
University of California, San Francisco	240,000
University of California, Santa Cruz	10,000
University of California, Riverside	1,380,000
University of California, Los Angeles	115,000
Rancho Santa Ana Botanic Garden	210,000
Research Institute of Scripps Clinic	69,000
Beckman Research Institute of the City of Hope	150,000
California State University, Hayward	50,000
California Polytechnic State University	49,740
Keith D. Allen	70,000
Elena del Campillo	93,000
Daniel F. Ortiz	84,300
USDA, ARS Pacific West Area	295,044
COLORADO	
Colorado State University	1,520,342
University of Colorado, Colorado Springs	90,000
University of Colorado Health Sciences Center, Denver	148,401
USDA, ARS Northern Plains Area	149,000
CONNECTICUT	
Connecticut Agricultural Experiment Station	172,500
University of Connecticut, Storrs	432,588
Yale University	328,000
DELAWARE	
University of Delaware	250,000
DISTRICT OF COLUMBIA	
Georgetown University	180,000
USDA, ERS, ARED	134,091
FLORIDA	
Florida State University	120,000
University of Florida	2,470,065
University of South Florida	125,000
GEORGIA	
University of Georgia, Athens	2,205,561
USDA, ARS South Atlantic Area	750,000
Mercer University	49,992
Institute of Paper Science & Technology	102,000

State/Recipient	Fiscal Year 1992 Actual
HAWAII	
University of Hawaii	516,754
IDAHO	
University of Idaho	494,935
ILLINOIS	
Illinois State University	200,000
Loyola University of Chicago	107,925
Northern Illinois University	120,000
Northwestern University	50,000
University of Illinois, Chicago	65,000
University of Illinois, Urbana	3,321,485
USDA, ARS Mid-West Area	938,500
INDIANA	
Butler University	50,000
Indiana University	45,979
Purdue University	2,269,491
IOWA	
Iowa State University	1,795,926
University of Iowa	412,000
Cornell College	49,539
Botanical Society of America	2,000
KANSAS	
Kansas State University	1,273,995
University of Kansas Medical Center, Kansas City	6,005
KENTUCKY	
University of Louisville	210,000
University of Kentucky	734,174
LOUISIANA	
Louisiana State University & A&M College	412,000
Louisiana State University Medical Center, Shreveport	200,000
Southern University and A&M College, Baton Rouge	10,880
USDA, Forest Service Southern Forest Experiment Station	150,000
MAINE	
University of Maine	483,092
Colby College	49,992
MARYLAND	
University of Maryland	665,663
Uniformed Service University of the Health Sciences	140,000
American Society for Cell Biology	12,500
USDA, ARS Beltsville Area	588,000
Advanced Bioscience Lab, Inc.	100,000
MASSACHUSETTS	
University of Massachusetts	429,000
Boston College	60,000
Boston University	140,000
Tufts University	453,105
Harvard University	338,000
Massachusetts General Hospital	325,000
Lawrence J. Zwiebel	86,400
MICHIGAN	
Central Michigan University	49,973
Michigan State University	2,148,040
Michigan Technological University	295,000
University of Michigan	844,167
MINNESOTA	
University of Minnesota	1,730,350

State/Recipient	Fiscal Year 1992 Actual
MISSISSIPPI	
Mississippi State University	455,124
University of Southern Mississippi	63,900
University of Mississippi Medical Center	50,000
MISSOURI	
University of Missouri	2,315,697
Washington University	520,000
Monsanto Agricultural Company	168,000
MONTANA	
Montana State University	687,287
University of Montana	220,000
NEBRASKA	
University of Nebraska	1,175,414
NEW HAMPSHIRE	
University of New Hampshire	204,111
Dartmouth College	180,000
NEW JERSEY	
Rutgers, The State University	1,606,900
NEW MEXICO	
New Mexico State University	459,875
NEW YORK	
Cornell University	3,714,021
State University of New York, Albany	654,780
State University of New York, Buffalo	10,000
University of Rochester	200,000
Boyce Thompson Institute	360,000
Rensselaer Polytechnic	100,000
Cold Spring Harbor Lab	138,000
Syracuse University	275,000
New York University	2,000
Vassar College	84,544
State University of Binghamton	50,000
Wells College	50,000
NORTH CAROLINA	
North Carolina State University	2,232,525
University of North Carolina, Greensboro	243,611
University of North Carolina, Chapel Hill	239,560
Bowman Gray School of Medicine at Wake Forest University	200,000
Duke University	409,300
East Carolina University	71,902
James D. Bever	82,400
NORTH DAKOTA	
North Dakota State University	472,224
OHIO	
Ohio State University	1,485,984
Ohio University	200,000
Case Western Reserve University	96,000
University of Dayton	100,000
Miami University	102,000
Bowling Green State University	110,000
Children's Hospital Medical Center	186,839
OKLAHOMA	
Oklahoma State University	976,159
University of Oklahoma	110,000
OREGON	
Oregon State University	2,387,029
Reed College	120,000

State/Recipient	Fiscal Year 1992 Actual
PENNSYLVANIA	
Pennsylvania State University	735,970
Duquesne University	50,000
University of Pennsylvania	515,000
USDA, ARS North Atlantic Area	225,000
University of Pittsburg	185,000
Swarthmore College	110,000
RHODE ISLAND	
Gordon Research Conference	22,600
University of Rhode Island	261,296
SOUTH CAROLINA	
University of South Carolina	34,056
Clemson University	548,327
Medical University of South Carolina	265,000
SOUTH DAKOTA	
South Dakota State University	656,879
TENNESSEE	
Vanderbilt University	5,000
University of Tennessee, Knoxville	1,732,913
TEXAS	
Texas Tech University	366,248
University of Texas, Austin	398,000
University of Texas Health Science Center	130,000
Southwest Texas State University	170,000
Baylor College of Medicine	100,000
Rice University	280,000
Prairie View A&M University	100,000
University of Texas Southwestern Medical Center at Dallas	520,000
Texas A&M Research Foundation	3,304,842
UTAH	
Utah State University	613,500
University of Utah	600,000
VERMONT	
University of Vermont	389,812
VIRGINIA	
Virginia Polytechnic Institute & State University	844,165
WASHINGTON	
Washington State University	835,000
University of Washington	1,004,200
WEST VIRGINIA	
West Virginia University	444,387
WISCONSIN	
University of Wisconsin, Madison	4,436,535
Forest Service, Forest Products Laboratory	710,000
Marquette University	100,000
WYOMING	
University of Wyoming	360,963
Total	92,138,350
Federal administration (4%)	3,900,000
Small Business Act	1,170,000
Biotechnology Risk Assessment	291,650
Total	97,500,000

Table 8
National Needs Graduate Fellowships Grants
Proposals Submitted and Grants Awarded in Fiscal Year 1992

	Proposals Submitted			Grants Awarded		
	Proposals Received	Fellows Requested	Dollars Requested	Grants Awarded	Fellows Supported	Dollars Awarded
Biotechnology Animal	33	127	$6,832,000	9	21	1,134,000
Food, Forest Products or Agribusiness Marketing	20	72	3,874,000	9	21	1,134,000
Food Science	18	64	3,456,000	6	10	540,000
Human Nutrition	19	68	3,687,000	6	11	575,520
Food Science/Human Nutrition	2	8	432,000	- -	- -	- -
Engineering - Food Forest/Products or Agricultural (a)	1	1	11,480	1	1	11,480
TOTAL	93	340	18,292,480	31	64	3,395,000

(a) Completion of funding for a partial fellowship awarded in FY 1991.

Table 9
National Needs Graduate Fellowship Grants
Fiscal Year 1992 Recipients
(In Dollars)

Area/Recipient	Fiscal Year 1992 Actual
BIOTECHNOLOGY - ANIMAL	
Colorado State University	108,000
University of Delaware	162,000
University of Florida	108,000
University of Illinois	108,000
Michigan State University	108,000
University of Minnesota	162,000
University of Missouri, Columbia	270,000
Cornell University, New York	108,000
ENGINEERING - FOOD, FOREST PRODUCTS OR AGRICULTURAL	
Pennsylvania State University (a)	11,480
FOOD SCIENCE	
Iowa State University	54,000
Purdue University	54,000
University of Minnesota	108,000
University of Nebraska	162,000
North Carolina State University	54,000
Ohio State University	108,000
HUMAN NUTRITION	
University of California, Davis	54,000
University of Chicago	108,000
Cornell University	162,000
Ohio State University	54,000
Pennsylvania State University	54,000
University of Wisconsin	143,520
FOOD, FOREST PRODUCTS, OR AGRIBUSINESS MARKETING	
University of California, Davis	108,000
University of Florida	162,000
Iowa State University	162,000
University of Illinois	108,000
Purdue University	162,000
Kansas State University	108,000
University of Minnesota	54,000
Ohio State University	162,000
Virginia Polytech Inst & State Univ	108,000
Subtotal	3,395,000
Federal administration (3%)	105,000
Total	3,500,000

(a) Completion of funding for a partial fellowship awarded in FY 1991.

Table 10
Competitive Challenge Grants
Fiscal Year 1992 Recipients
(In Dollars)

Recipient	Fiscal Year 1992 Actual
University of Florida	$56,149
University of Georgia	123,306
University of Hawaii, Manoa	63,956
University of Illinois	127,910
Purdue Research Foundation	119,608
Kansas State University	121,133
Morehead State University	60,254
University of Massachusetts	51,386
University of Maryland	63,952
Michigan State University	64,000
University of Minnesota	80,000
New Mexico State University	40,000
Research Foundation of State University of New York	61,629
Cornell University	125,462
State University of New York, Albany	62,054
Ohio State University Research Foundation	63,958
Texas A&M University System	108,883
University of Vermont	61,360
Subtotal	1,455,000
Federal administration (3%)	45,000
Total	1,500,000

Table 11
1890 Institution Capacity Building Grants
Fiscal Year 1992 Recipients
(In dollars)

Category/Recipient	Fiscal Year 1992 Actual
Research Capacity Building Grants	
Alabama A&M University	$771,797
Tuskegee University, Alabama	585,621
Delaware State College	240,694
Florida A&M University	584,932
Fort Valley State College	401,365
Kentucky State University	328,000
Alcorn State University, Mississippi	287,456
Langston University, Oklahoma	638,366
South Carolina State College	314,928
Tennessee State University	314,857
Prairie View A&M University	363,996
Virginia State University	72,808
Subtotal, Research Grants	4,904,820
Teaching Capacity Building Grants	
Alabama A&M University	215,810
Tuskegee University, Alabama	401,986
University of Arkansas-Pine Bluff	401,522
Florida A&M University	402,675
Fort Valley State College, Georgia	164,135
Southern University	202,500
University of Maryland-Eastern Shore	452,439
Lincoln University	597,863
Alcorn State University, Mississippi	574,337
North Carolina A&T State University	602,278
Langston University	349,241
South Carolina State College	202,229
Prairie View A&M University	202,500
Virginia State University	201,735
Subtotal, Teaching Grants	4,971,250
Federal administration (3%)	307,500
Small Business Act	62,141
Biotechnology Risk Assessment	4,289
Total	10,250,000

COOPERATIVE STATE RESEARCH SERVICE

STATUS OF PROGRAM

Current activities, progress, and current programs under the CSRS appropriation items are outlined below:

PAYMENTS UNDER THE HATCH ACT

The Hatch research program at the State Agricultural Experiment Stations is designed to promote efficient production, marketing, distribution, and utilization of crops and livestock essential to the food supply, health and welfare of the American people while conserving resources and improving rural living conditions. Equally important, students are provided training opportunities to assist in scientific research projects conducted at the State Agricultural Experiment Stations.

The following describes current activities and selected examples of accomplishments supported under this appropriation item.

CURRENT ACTIVITIES

Hatch Act funds support the following types of research.

-- Forest and Natural Resources - Thirteen percent of total Hatch research funds are allocated to this program. Areas of research include forestry, soil and land use, water and watersheds, outdoor recreation, environmental quality, fish and wildlife, and remote sensing. Forestry related research under the Hatch Act is closely coordinated with the McIntire-Stennis Cooperative Forestry Research program which has similar research objectives. The Hatch forestry research program is characterized by a high degree of multi-institutional or regional projects.

-- Crop Resources - This program receives forty percent of total Hatch funds for research. Included in this research are crop protection and production systems for dependable and efficient production, quality improvement, quality maintenance, product development, and related commodity aspects of crops marketing.

-- Animal Resources - Twenty-seven percent of total Hatch funds are allocated to this research program. Areas of research include protection, production, and management of beef and dairy cattle, swine, sheep, other animals, poultry, and aquaculture. Also included are quality improvement, product development, and related commodity aspects of marketing.

-- People, Communities, and Institutions (Including Rural Development) - This program receives five percent of total Hatch funds for research. Included in this area are individuals and families, living environment, communities, institutions, and services.

-- Competition, Trade, Adjustment, Price and Income Policy - Six percent of total Hatch funds for research are allocated to this program. This research addresses farm adjustments, prices and income, economic aspects of marketing, and competition.

-- Food Science and Human Nutrition - This program receives five percent of total Hatch funds for research. Research areas include human nutrition, food processing, food safety, food service and storage, distribution, and marketing.

SELECTED EXAMPLES OF RECENT PROGRESS

Water and Energy Conservation in Irrigation Management. Irrigation management techniques, with emphasis on conservation of water and energy, have been developed and implemented by the Bioresources Engineering Department at Oregon State University. Deficit irrigation strategies, using less water with more careful management, show that irrigation water use can be reduced by 25 to 50 percent with no effect on profitability. This strategy was implemented by the Eastern Oregon Farming Company and was a factor in the company winning the United States Presidential Energy Conservation Award in 1988. The competing demands for water, particularly in the Western United States, make this type of research critical for U.S. agriculture.

Biodegradable Plastic. A University of Minnesota research team has developed a biodegradable plastic using lignin as the building block. Lignin is the second most abundant polymer, after cellulose, and is found in plant material. It is a major by-product of wood pulp manufacture and a cohesive, bendable substance has been produced completely from lignin. The raw material from which the plastic is to be made will decompose within four weeks after being subjected to certain conditions. This research takes a polymer that presently is used as a fuel with little value and makes from it a biodegradable plastic with considerable commercial potential.

Improved Irrigation Management Reduces Pollution While Maintaining Profits. Research by agricultural scientists in Washington and Oregon has been successful in improving farm irrigation system management in the Pacific Northwest. New computer models have been validated under local conditions to control the uniformity of irrigation, and by linking with models for crop production, can help reduce nitrate pollution of ground water from irrigated agriculture. Results from these studies have indicated that up to 40 percent of current nitrate movement to ground water can be eliminated through improved irrigation and fertilizer management with minimal loss of net farm income. However, additional increases in pollution abatement become increasingly expensive.

Ground Penetrating Radar Helps Detect Pollution Under Farm Fields. Ground penetrating radar has been shown by researchers in New York and Wisconsin to be a new and effective tool in determining the routes that possible pollutants take on their way to the ground water. The radar creates a colored image on a computer screen that shows the flow of pollutants in water through the subsoil, and helps better predict which soils or subsurface conditions are more susceptible to movement of pollutants through them to ground water. These studies show that layered soils have a substantial effect on how water and potential pollutants move through the media. The research will assist in developing soil and crop management practices for those soils which make more efficient use of fertilizer and pesticides while still protecting the environment.

Building Family Strengths. Currently in the U.S., more marriages end by divorce than by death of a spouse; almost one-half of the Nation's children born in the 1970's and 1980's have or will experience parental divorce. Researchers in Minnesota have assessed the economic and social consequences of divorce, developed measures and designed programs to improve the foundations of high quality marriages through premarital enrichment programs. This research and program development has had a significant impact on the well-being of both rural and urban children and their families.

Food Preservation and Process Control by Bacteriocins. Bacteriocins are bactericidal proteins produced by bacteria that are effective in inhibiting or controlling the growth of spoilage or food poisoning bacteria in foods. Researchers in South Carolina have found that a bacteriocin produced by

propionibacteria may inhibit growth and acid production of other propionibacteria and lactobacilli that cause over-ripening and over-acidification of yogurt and similar fermented dairy products. Meanwhile researchers in Massachusetts isolated a lactic acid bacterium that produces bacteriocin exhibiting extraordinary broad spectrum lethality against a wide range of spoilage and food poisoning bacteria. It may have considerable potential as a refrigerated food preservative and as a substitute for nitrite in processed meat products.

Differential Effects of Types of Fiber on Gut Cell Proliferation. Texas scientists have researched the interactive effects of fibers and fats on colon physiology to improve understanding leading to colon cancer prevention. Different fibers have differential effects on colon physiology; effects are site specific and dependent on type of dietary fat. Wheat bran and cellulose, which are the less fermentable fibers, result in a quiescent cell proliferation pattern in the colon which should be protective of cancer. With respect to fats, fish oil produced the most protective patterns when compared to beef tallow or corn oil. The main effects of fibers were observed in the proximal colon, whereas the main effects of fat were seen in the distant colon. The interactive effects were seen both proximally and distally. These findings explain some of the confusion that exists regarding the role diet plays in cancer development.

Regulation of Lipoprotein Receptor and Genes by Dietary Lipids. Researchers in Arizona investigated the effects of dietary saturated, monosaturated, and polyunsaturated fats, or cholesterol on regulation of low-density lipoprotein receptor and the expression of lipoprotein genes. The receptor controls uptake of lipoproteins and the expression of specific genes control lipoprotein production by the liver in guinea pigs. Both uptake and expression were found to respond to dietary fatty acid chain length and unsaturation. Low-density lipoprotein receptor expression increased as fatty acid chain length and unsaturation increased. The increased receptor expression correlated with increased breakdown of plasma low-density lipoprotein. Addition of cholesterol to the diet resulted in dose dependent reduction in hepatic receptor expression independent of the type of dietary fat. These findings provide a molecular mechanism of how dietary lipids alter the level of low-density lipoprotein which is closely associated with development of cardiovascular disease.

Dispersal of Sweet Potato Whitefly and Implications for Area-wide Management. Previous assumptions that sweet potato whiteflies (SPWF) have limited ability to migrate long distances have been demonstrated to be incorrect by research conducted at the Arizona Agricultural Experiment Station. Area-wide management of SPWF is an essential feature of future management programs. It has been demonstrated that SPWF populations can stay aloft for more than 2.5 hours. Staying aloft for this length of time in a wind of only 5 mph would allow SPWF populations to travel 12.5 miles. In addition flight was found to be influenced by SPWF age and host quality. Dispersal occurs primarily in the spring when populations leave over wintering hosts such as cheeseweed and groundcherry, and in the late summer/early fall when SPWF populations are experiencing the exponential phases of growth and are moving from cotton to vegetables and alfalfa. Problems in vegetable production are associated with these massive migrations in the fall. Information concerning the migratory process has enabled Arizona growers to significantly reduce losses to the vegetable crops during the 1992 growing season in Arizona.

Fingerprinting for Identifying Genetic Background of Poultry Stocks. Use of DNA fingerprints has proven effective in poultry populations for identifying individuals and/or evaluating genetic relationship. Commercial poultry stocks are controlled and bred by a very small number of breeding organizations, thus

the degree of relatedness among various stocks may be great. These new molecular techniques were developed by scientists at Virginia Polytechnic Institute and State University in cooperation with scientists in Israel. This research development should permit geneticists to evaluate levels of genetic diversity of breeding stock and provide predictions for both short and long term genetic progress.

Biodegradation and Utilization of Feathers. Researchers at North Carolina State University have discovered a bacterium capable of degrading feather keratin. The bacterium can ferment and convert poultry feathers to digestible feed protein and amino acids. The enzyme keratinase was purified from the bacterial medium. It is a fairly stable and potent protease which hydrolyzes a broad range of protein substrates. As a feed additive, the keratinase was demonstrated to be able to enhance the protein digestibility in animals. The keratinolytic bacterium and enzyme are believed to have other industrial and environmental applications such as food processing, pharmaceuticals, and waste treatment.

Computer Program Assists Farmers with Weed Control for Environmental Safety. The computer program HERB (a trade name registered by North Carolina State University) was developed to help producers, extension personnel, and private consultants evaluate potential crop damage from multi-species weed complexes in soybean, determine if a herbicide treatment is economically justified, and if so, select any appropriate herbicide and rate of application. The program is also expected to be useful in weed science and crop production courses. Traditional weed control systems have included the use of preplant incorporated or pre-emergence herbicides that must be applied before emergence of weeds. By delaying a herbicide use decision until after crop and weed emergence, a producer can more accurately assess the extent of the weed problem and reduce the risk of applying unnecessary or inappropriate chemicals. The successful shift from use of preplant incorporated or pre-emergence herbicides to post-emergence herbicides depends on the ability of producers to determine when weed densities exceed economic thresholds.

Five other States (Mississippi, Georgia, Kentucky, Nebraska, and Iowa) are using the program, modified with research information generated at their respective State's Agricultural Experiment Station. In North Carolina, the HERB program is helping to reduce acres treated unnecessarily with herbicides, and the program has resulted in an estimated $500,000 savings in weed control costs in 1991. At least similar, if not greater, savings are expected in other states as the program adaptation increases in number. Other "savings" include reduction in surface and ground water contamination as the amount of pesticides are reduced per acre. This outstanding program has been developed with Hatch and State research funding at the North Carolina Agricultural Experiment Station, North Carolina State University.

Biocontrol Agent for Multiflora Rose. Scientists at Iowa State University are concluding tests of a very effective biocontrol agent of multiflora rose. Multiflora rose is a frequent pest in pastures, grasslands, fence rows and road sides. Although the biocontrol agent has not conclusively been identified, it is readily transmitted through plant grafts and somewhat by mites. In controlled tests, the agent slowly weakens and eliminates the rose pest. For Iowa and the Midwest, an effective control of wild multiflora rose would reclaim or improve thousands of acres of valuable grazing and recreational land.

Southern Corn Leaf Blight. Working with the infamous and important pathogen of Southern corn leaf blight, Cochliobolus heterostrophus (Helminthosporium maydis) at Iowa State University, scientists have developed the most complete genetic map of any fungal plant pathogen to date. The detailed map of each chromosome of this fungus permits specific genetic manipulation to both determine and alter

its aggressiveness on corn. Ultimately the research offers information useful to efficiently breed corn varieties that resist blighting and to attenuate the pathogenicity of the fungus.

Aquaculture. Scientists at Mississippi State University are conducting studies to characterize the effluents from aquaculture production systems. Levels of settleable solids, suspended solids, phosphorus and nitrogen have been determined to form the effluents of channel catfish production ponds. Water budgets and models have been developed to estimate waste quantities under various management and hydrologic regimes. This research has led to the development of effluent management practices for the catfish industry.

Chemical Communication Systems in Fruit, Vegetable, and Turf Insects. The New York Agricultural Experiment Station, Geneva, New York is supporting a major program in chemical communication systems and the management of pests with alternative control tactics. Besides Hatch Act and State funding, additional support is obtained through grants from the National Science Foundation, National Institutes of Health, the USDA National Research Initiative, and the Cornell Biotechnology Program. The basic research program is centered in a developmental research station that concurrently puts new knowledge developed in the laboratory into field application. Studies on chemical communication systems targeted for species-specific manipulations have demonstrated that the grape berry moth, a key pest in grapes, can be managed with pheromone disruption alone. When insecticides are removed for the control of grape berry moth, there is a great potential that other insect pests in the grape system can be managed with biological control agents and associated cultural practices. Other studies manipulate chemical communication systems in fruit, vegetable, turf, and household pest systems. Multi-disciplinary collaboration between this base program and several state, Federal, and international organizations is extensive. Whereas current novel control strategies are based on species-specific monitoring traps and mating disruption techniques, future technologies are being investigated that will depend on a thorough understanding of the enzymes, hormones, genes, neuromodulators, and genetics involved in these communication systems.

COOPERATIVE FORESTRY RESEARCH

The Cooperative Forestry Research (McIntire-Stennis) program provides knowledge essential to the efficient and effective use of the Nation's forest resources. Timber production, forest land management, wood utilization, and the associated development of new products and distribution systems are the key elements of forestry research. This research also deals with the other forest products -- wildlife, recreation, water, range, and environmental quality -- whose production, management, and distribution are an inextricable part of the long term productivity and profitability of the integrated system of forest resources.

In addition, the Cooperative Forestry program has the objective of helping to create and maintain a highly qualified cadre of forest scientists through their direct involvement in the research projects as a part of their graduate education. These young men and women, educated in the sciences fundamental to forestry, will ultimately help to maintain the well-being of the United States through service in private industry, in various levels of government, and in academic institutions as managers and scientists.

Following is a description of some of the major activities of the program and selected examples of accomplishment supported under this appropriation item.

CURRENT ACTIVITIES

The following research program activities indicate the range of research funded under this Act:

Forestry research is broadly inclusive and thus deals with many of the current concerns of the Nation. Several areas that have long been important in forestry research include acid rain, global climate change, recreation, wetlands, reforestation, and carbon dioxide concentration in the atmosphere.

Increasing the profitability of the forest resource base through effective management of the forest resource is being vigorously pursued.

Biotechnology in forestry promises to enhance the benefits from modified trees due to faster growth rates, improved wood characteristics for various uses, and greater freedom from losses due to insects and diseases. The latter achievement would reduce the need to use chemicals to control these forest pests, thus benefiting the environment.

The advent of high capacity microcomputers has made possible several developments in information management such as: expert systems, data base manipulations, and map and image processing. Forestry research is combining these new tools for improved management capability for production of the multiple outputs of forests.

Water quality and quantity is a major aspect of forest management which is becoming more essential as our population grows. Forests cover one-third of the nation's land and are initial recipients of an even larger portion of the precipitation received. Research to improve water yield from forested watersheds is a major thrust.

Forest wildlife research is providing essential information for science-based wildlife management. This research is also the basis for forest managers to understand and deal with the impacts of wildlife on the forest, as well as to know the effects of forestry practices on wildlife species associated with forests.

Changes in the agricultural economy make it imperative that research efforts focus on enhancing productivity and conserving resources. Research programs are seeking to develop knowledge and techniques which will facilitate wise choices in the utilization of the nation's forest resources.

SELECTED EXAMPLES OF RECENT PROGRESS

Research Brings Improvements to Lumber Processing. Researchers in Oregon have developed improved moisture meters to control lumber drying processes that save lumber manufacturers about $3 million per year in reduced lumber defects during kiln drying. In cooperation with the U.S. Forest Service, researchers in Virginia have developed a procedure for designing safe, efficient pallets. This procedure has improved 25 percent of the over 500 million pallets produced each year in the U.S. With over 18 percent of the timber produced in the U.S. ending up in pallets, this procedure provides for the safe movement of materials in an efficient manner. Mississippi researchers have developed a computer program to determine the appropriate product mix for plywood plants which will return in excess of $1 million per plant per year. Last year 14 plants utilized the model.

Geographic Information Systems. In the past, inventory of the nation's timber supply and its health has been conducted mainly by costly, time consuming, ground surveys. Studies in Maine, Wisconsin, New Jersey, Minnesota, and North

Carolina have assessed remotely sensed data to determine how accurately it inventoried forested areas. Classification accuracy ranged from 73 percent to 99 percent, with the lower accuracy associated with urban areas or dry, bare agricultural fields. Remote sensing techniques will allow better, more timely estimates of the condition of the forest while simultaneously saving many tax dollars.

Timber Bridges. Timber bridges have several attributes making them desirable for rural roads when compared to steel or concrete construction. Researchers in Maine, Pennsylvania, and West Virginia are exploring these attributes by designing bridges for specific sites or through generic designs for spans ranging from 18 to 90 feet. Timber treated with wood preservatives and of several species indigenous to these States has been used to manufacture test bridges for active roadways. Such bridges offer opportunities for domestic use as well as international trade. Domestically, timber bridges have proven to be less costly to build and install, reducing tax burdens. The industry that may emerge from these research results has been estimated in excess of $600 million. About 200 rural bridges collapse each year in the United States and 40 percent of the 575,000 bridges need repairs according to Federal transportation estimates.

EVANS-ALLEN PROGRAM, 1890 COLLEGES AND TUSKEGEE UNIVERSITY

The Evans-Allen formula-funded research program for the 1890 Colleges and Tuskegee University was established in the Food and Agriculture Act of 1977, as amended. Section 1445 of P.L. 95-113 authorized annual appropriations to support continuing agricultural research at the 1890 Colleges and Tuskegee University and funds were appropriated beginning in FY 1979. This program indirectly supports development of agricultural expertise by providing training opportunities for students to assist in the research projects being conducted by scientists at these institutions.

The following is a description of current activities and selected examples of accomplishments supported under this appropriation item.

CURRENT ACTIVITIES

The annual research program at the 1890 Colleges and Tuskegee University places emphasis on small-scale agriculture, human nutrition, rural development and quality of living, crop resources, and animal resources.

Small-Scale Agriculture. Research on farm systems for small scale producers must be totally integrated into a comprehensive plan responsive to total needs of a particular farm enterprise system coupling production, utilization, and marketing of the farm commodity. In order to increase agricultural incomes from small farm units, total comprehensive research plans have been developed that consider all aspects of cost and management efficiencies in production, utilization, and marketing and then integrate these separate factors into a comprehensive program package.

Human Nutrition. Human nutrition research provides fundamental knowledge about the relationship of food eaten by people to their physical and mental status and development and the levels of well-being maintained during their life span. Research has also been conducted on human requirements for nutrients.

Rural Development and Quality of Living. Research on income improvement in rural communities identifies ways by which depressed areas can attain full economic potential. Only by providing adequate income opportunities can these communities retain more of their young people and finance the kind of public and private facilities and services that make them attractive places to live.

Crop Resources. Breeding, selection, and use of crops is a major concern of scientists. This includes development of drought, insect, and disease resistant cultivars. Evaluation of the efforts of crops to be grown on soils not suitable for commonly grown crops because of pathogens, nematodes, and insects are being undertaken. Studies are being conducted on the mechanisms of both natural and artificial regulators that are known to influence plant growth and development.

Animal Resources. Studies are being conducted on disease, parasites, and other health hazards that are major causes of reduced productivity in food animals. Research objectives are aimed at the development of technology for prevention, treatment, and control of these problems. Research of sufficient concentration is being undertaken to elucidate the cellular mechanisms that govern protein and fat synthesis in farm animals. Investigations of genetic, nutrition, and endocrinological factors provide needed information on biomechanisms.

SELECTED EXAMPLES OF RECENT PROGRESS

Changes in Poultry Litter Toxicity with Simulated Acid Rain. Litter extract is a complex mixture of many different chemicals. Metal ions and organic pollutants are known to exhibit complex interactions. Increasing the concentration of organic compounds can reduce the toxicity of metal ions. Many organic chemicals such as phenol are known to exhibit reduced toxicity over time. A reduction in toxicity may then take place with an increase in extraction time or a decrease in pH. University of Maryland-Eastern Shore scientists observe that increasing acidity of the extracting water reduced the toxicity of the leachate from poultry litter.

Dietary Practices and Nutritional Health of Selected Low-Income Families in Louisiana. Studies conducted at Southern University among selected Louisiana families with annual incomes below $5,000 revealed that most households did not use recipes or convenience foods and most dishes were prepared from original ingredients. Dietary intake findings indicated the food groups most frequently consumed by all individual were cereals and grain products followed by vegetables and other legumes. Beef was the most popular meat for rural/urban residents, while pork was the most popular meat for rural residents. The dietary findings further revealed that diets of the population studied were adequate. There was, however, variation in the adequacy of each nutrient intake. The results of this study suggest that faulty eating patterns may cause major nutritional health problems such as hypertension, impaired glucose tolerance, ischemic heart disease, obesity and hypertension.

Processing and Storage of Southern Agricultural Commodities. Researchers at North Carolina A&T State University have developed an enzymatic procedure to convert starch and lactose from food processing wastes like bakery products, milling scraps, cookies, chips, and dairy products to ethanol. This was accomplished using a combination of fast-acting, high-temperature enzymes. When cheese whey, which contains lactose, is co-fermented with starchy wastes, the total ethanol yield increases by 36 percent. Increased alcohol yield and reduced processing time are two key parameters that influence the economic feasibility of converting biomass to alcohol.

Effect of Genetic Agronomical and Environmental Factors on Peanut Seed Quality. Scientists at Florida A&M University have identified a protein marker in the peanut seed which will be useful to determine the maturity status of the seed. In addition, factors affecting natural resistance of peanut to aflatoxin contamination have been identified which would enable the industry to reduce aflatoxin contamination of peanut seed.

ANIMAL HEALTH AND DISEASE RESEARCH

The Animal Health and Disease Research (Section 1433, Public Law 95-113, as amended) formula program is dedicated to improving the health and productivity of animals and the welfare of producers and consumers of animal products; protecting human health through control of animal diseases transmissible to humans; minimizing livestock and poultry losses due to transportation and handling; and facilitating the effective treatment and prevention of animal diseases.

The following is a description of current activities and selected examples of accomplishments supported under this appropriation item.

CURRENT ACTIVITIES

Funds for this program have been appropriated since FY 1979. Institutions receiving FY 1993 funds include 38 State Agricultural Experiment Stations and 17 Colleges of Veterinary Medicine qualifying individually. Additionally, at 13 other universities the Station and Veterinary College qualified as combined institutions. Legislative amendments contained in Public Law 97-98, provide that an "eligible institution" for Animal Health and Disease Research funds "means an accredited school or college of veterinary medicine or a State Agricultural Experiment Station that conducts animal health and disease research."

Recommendations of the Animal Health Science Research Advisory Board are being followed in program implementation (i.e., scope and priorities of eligible research, determination of research capacity of eligible institutions and other questions on program administration). In accordance with advice from the Board, emphasis in this research centers on the solution of high priority diseases or other animal hazards in the production of livestock, poultry, and aquaculture species.

State Comprehensive Plans for animal health research, approved by CSRS, are being followed by the eligible institutions within each State. These plans include the major areas of animal health research to be conducted by the institutions. Provisions of Section 1433 permit selection of studies within each State based on highest priority needs and capabilities of the institutions to conduct the needed research.

SELECTED EXAMPLES OF RECENT PROGRESS

Bovine Viral Diarrhea Virus. Collaborative research at Kansas State University, Ohio State University, Colorado State University and the University of Nebraska has identified important genetic variants of bovine viral diarrhea virus. These research findings help in explaining the epidemiology of the disease and apparent vaccine failures. While these results are significant, researchers suggest that further research is needed to find the extent of this antigenic heterogeneity among bovine viral diarrhea virus isolates and methods for preventing the disease.

Infectious Bronchitis. Scientists at the University of Georgia are conducting research on the polymerase chain reaction to develop restriction enzyme analyses for the diagnosis of infectious bronchitis in chickens. In collaborative work with the University of Delaware, the technique has proven useful for accurately identifying variant infectious bronchitis virus. The results are being refined for application to the diagnosis and control of serious outbreaks on infectious bronchitis caused by variant viruses in the major poultry producing areas of the U.S.

1890 INSTITUTION CAPACITY BUILDING GRANTS (FEDERAL ADMINISTRATION - DIRECT APPROPRIATION)

CURRENT ACTIVITIES

The 1890 Institution Capacity Building Grants Program, begun in FY 1990, serves as the crux of the Department of Agriculture's high priority initiative to advance the teaching and research capacity of the 1890 Land-Grant Institutions and Tuskegee University. It reflects USDA's commitment to encouraging more minorities to prepare for careers as food and agricultural scientists and professionals. The program is competitive in nature and provides support for teaching and research projects in targeted high priority areas. Matching support from non-Federal sources has been encouraged and the 1890 institutions have demonstrated an ability to attract matching funds. The program also requires cooperation with one or more USDA agencies in developing a proposal and carrying out a project, thereby, strengthening departmental partnerships and linkages with these important historically black institutions.

SELECTED EXAMPLES OF RECENT PROGRESS

In FY 1992, $10.25 million were appropriated for the Capacity Building Grants Program. Of this amount, approximately $5.0 million were allocated to support teaching projects and about $4.9 million were allocated to research projects. Targeted need areas for teaching projects included curricula design and materials development, faculty preparation and enhancement, instruction delivery systems, student experiential learning, instrumentation for teaching, and student recruitment and retention within the fields of agriculture, natural resources, forestry, veterinary medicine, home economics, and closely allied disciplines. Research areas included studies and experimentation in the food and agricultural sciences, establishment of centralized research support systems, and development of improved technology delivery systems for producers and consumers concerned with the food and agricultural system.

In FY 1992, 49 grants were awarded competitively. The following reflects the number of proposals submitted and grants awarded.

	Proposals Submitted		Grants Awarded	
	Proposals Received	Dollars Requested	Grants Awarded	Dollars Awarded
Research Grants	133	$37,314,193	22	$4,904,820
Teaching Grants	60	12,563,262	27	4,971,250
TOTAL	193	49,877,455	49	9,876,070

With the support of the Capacity Building Program, North Carolina A&T State University and Tuskegee University have launched complementary projects to strengthen the instruction delivery system of each institution through telecommunications and distance learning programs, Additionally, an urban forestry curriculum is being established at Southern University to provide professional ethnic diversity in the work force. Research is underway at Fort Valley State College to evaluate the use of physiological and exogenous stimuli on the control of breeding in dairy goats. Alabama A&M University is conducting research on the potential use of videographic technology, remote sensing, and geographic information system (GIS) for managing watersheds and forested lands. These are just a few examples of how the program is advancing the quality of teaching and research at the 1890 institutions.

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SPECIAL RESEARCH GRANTS

The Special Research Grants program concentrates on problems of national and local interest beyond the normal emphasis in the formula programs. The objectives of this program are to facilitate or expand promising breakthroughs in areas of food and agricultural sciences of importance to the Nation and to facilitate or expand ongoing State-Federal food and agricultural research programs.

Following is a description of current activities and selected examples of accomplishments supported under this appropriation item.

CURRENT ACTIVITIES

In FY 1993 under the Special Research Grants program, grants will be awarded to the headquarters and four regional leader laboratories (New York, Michigan, Florida, and California) to continue the pesticide clearance and minor use animal drugs research programs. Regional/National impact grants will also be awarded in a number of other areas including water quality, global change, integrated pest management, pesticide impact assessment, and the National Biological Impact Assessment Program.

In FY 1992, selected Special Research Grants were awarded competitively. Listed below are details on the number of proposals submitted and grants awarded.

Specific Area of Inquiry	Number of Proposals Submitted	Amount Requested	Number of Grants/ Agreements Awarded	Amount of Awards
P.L. 89-106:				
Aquaculture	19	$1,435,401	5	$299,145
Integrated Pest Management	285	32,275,192	59	4,219,268
Water Quality	410	52,013,218	79	8,519,949
P.L. 97-98:				
Rangeland	36	2,484,906	6	454,991

SELECTED EXAMPLES OF RECENT PROGRESS

Minor Use Animal Drugs. Losses from animal diseases cost the American farmer billions of dollars annually. The Minor Use Animal Drug Program, conducted under the Interregional Research Project (IR-4) and sponsored by funding from the USDA/CSRS in cooperation with the Food and Drug Administration (FDA), provides a means for the approval of animal drugs for minor species and/or minor uses to control some of these diseases. The need for these drugs is paramount for production of these minor species and currently is not being met by the pharmaceutical industry due to economic restrictions. The Minor Use Animal Drug Program has provided research necessary to obtain approval by FDA for the use of ivermectin in foxes for the control of ear mites. This research was conducted in the State of Washington. Research in Tennessee has led to approval of morantel tartrate as an antihelminthic for goats. Also, studies have been conducted in Idaho on long acting oxytetracycline for the treatment of bacterial pneumonia in sheep.

In cooperation with the Minor Use Animal Drug program, the USDA, the aquaculture industry, and the FDA, a new research program concerning Investigational New Animal Drug (INAD) has been initiated. The mission of this program is to conduct efficacy studies on drugs to gather data to pursue the approval of these drug products for the aquaculture industry throughout the United States.

Pesticide Clearance. Interregional Research Project No. 4 (IR-4) is a federal program to clear pest management products for use on minor crops. IR-4 conducts research to develop residue and crop safety data to support registrations and reregistrations of pesticides and the clearance of biological control agents on minor food crops and ornamentals. IR-4 responded to the 1988 amendments to FIFRA by developing a strategic plan to defend up to 1,000 primarily pesticide registrations on minor crops that would not be supported by commercial registrants for economic reasons.

In 1992, IR-4 conducted research on 338 minor use clearance requests, 25 percent of which were for the reregistration of currently labeled uses. During this period, 101 regulatory packages were finalized in support of label expansions, product reregistrations or tolerance petitions. In 1992, 283 ornamental registration research projects were conducted and data were submitted to industry to support 98 new labels for ornamental crops.

IR-4 also submitted a petition for the exemption for the codling moth granulosis virus for biological control of codling moth larvae on apples, pears, plums, prunes and walnuts; and assisted in the development of a biological organism for disease control on mushrooms. IR-4 is currently funding research on the biological control of dodder, a parasitic weed, and the imported red fire ant.

IR-4 often petitions EPA for expansion of their listing of crop definitions. Recently, EPA approved IR-4's requests to include lentils under the general crop definition of "broccoli"; and birdsfoot trefoil under the general crop definition of "alfalfa". Expanded crop definitions greatly facilitate the clearance of needed pesticides on minor crops.

Economic benefits of IR-4 activities include: an increased return of up to $1,000 per acre to growers resulting from the clearance of glyphosate on cranberries; a 94 percent increase in crop yield for Pennsylvania mushroom growers by the registration of benomyl for disease control; annual yield benefit of $268 per acre to mint growers in Oregon, Washington, Idaho and Montana resulting from the registration of chlorpyrifos to control the mint root borer; and an annual savings of $10 million/year to the bee industry through the registration of menthol for control of tracheal mites on overwintering honey bees.

Global Change. In March 1992 a second international workshop in UV-B monitoring was held in Washington, D. C. The workshop was well attended and provided an excellent opportunity for interaction between "effects" researchers and the measurement and monitoring community. The second part of the workshop focused on instrumentation needs for status and trends UV-B monitoring. Two printed reports resulted from this workshop: "UV-B Monitoring Workshop: A Review of the Science and Status of Measuring and Monitoring Programs" and "Criteria for Status-and-Trends of Ultraviolet (UV) Radiation." Building on this information the UV-B Site Selection Criteria Committee was held with participants from Canada, EPA, National Center for Atmospheric Research (NCAR), NOAA/ERL, USDA, and four universities attending. Funding from the CSRS Competitive Research Grants program supported development at the State University of New York, Albany of the first research spectroradiometer which is currently being characterized and calibrated at NIST. It is scheduled for installation and operation at the Department of Energy's Atmospheric Radiation Measurement (ARM) site in Oklahoma early in 1993. Several more of these instruments are to be built and deployed to form the research caliber monitoring network. For the status and trends network broadband meters and second generation Smithsonian Spectral UV-B radiometers will be installed during the next few months. Funding from the CSRS Special Research Grants Program is providing for the operating network which is managed by Colorado State University.

Integrated Pest Management. After several years of research, scientists studying a disease that causes premature death of potato vines concluded that less, not more irrigation is best during the first six weeks after planting. The disease, called potato early dying (PED), is most critical in the irrigated areas of the north central, southern, and western states where growers rely primarily on soil fumigation and crop rotation to control the disease. Concerns about chemical drift and groundwater quality, however, may prevent or reduce future fumigant use.

PED, caused by the soilborne fungus Verticillium Dahliae, significantly reduces yields. It is especially severe in areas where potatoes are grown in hot, dry conditions under irrigation. No potato varieties are immune to PED, according to researchers at Oregon State University, but several varieties have varying degrees of resistance to the fungus.

In cooperative efforts, plant pathology and soil scientists from Oregon State University and the University of Wisconsin conducted a multidisciplinary study of the influence of soil moisture on the PED fungus. This new angle of research is funded by the Western Regional IPM program.

The researchers found that irrigation management limiting soil moisture in the early portion of the growing season can suppress the severity of PED two- to four-fold. Data also showed that yields in plots receiving excessive irrigation early in the season were reduced by 18 percent compared with plots receiving low or moderate amounts of water. Irrigation management can be an effective component of an integrated disease management program. In addition, modified water use may lessen fertilizer leaching and groundwater contamination.

Pesticide Impact Assessment. The Pesticide Benefits Assessment model (PBA), developed by researchers at Ohio State University, has been successfully pilot tested by cooperators in ten states. PBA is a software program for data acquisition and benefits assessment of pesticides and other pest control agencies in agricultural production. It allows for an economic comparison of various pest control strategies after a variety of production costs are calculated, pest control methods are evaluated for cost and efficacy, the number of treated acres are tabulated, crop yields are measured, and crop sales values are determined. Cooperators were uniformly positive on the usefulness of the program. It provides a standardized data format which is easily updated, a rapid assessment of the actual or potential loss of a pest control agent, and the ability to make predictions about crop production and economic returns.

Water Quality. A survey of over 1500 producers was conducted by researchers in Iowa, Minnesota, and Nebraska to evaluate farmer attitudes about water quality and their willingness to make changes to protect the water resources. The response rate exceeded 60 percent in each state. Farm size did not appear to be a factor in defining attitudes toward water quality and environmental issues. The majority of Minnesota farmers utilize soil testing, reduced tillage and chemical or mechanical weed control in their operation. Nebraska producers identified nitrate in the ground water as a significant problem that must be considered in making production decisions. Iowa producers feel that with proper management decisions changes in water quality can be accomplished.

A Geographic Information System (GIS) has been developed for the Muddy Fork watershed in Northwestern Arkansas. Statistical correlations and regressions were used to relate landscape features to the nitrate-nitrogen concentration in local wells and springs. A computer model has been developed to describe the fate of nitrogen in poultry litter applied to pasture land. The GIS coupled with an economic model for the watershed will assess the impact of poultry litter upon the water quality of the region. The technique should be applicable to other watersheds.

California researchers studied high levels of selenium in agricultural drainage water and addressed the need for remediation of such waters. Indigenous bacteria isolated from the water have been found to have the ability to volatilize selenium and significantly reduce the selenium in the waters. The goal is to develop a cost-effective system for removal of selenium from water using the accelerated methylation process. Reduced selenium levels in agricultural drainage waters will protect wildlife which live in or near the water.

Tropical-Subtropical Research. Scientists at Florida and Puerto Rico are cooperating on developing short-vined, disease-tolerant, high-quality calabazas squash. This type of squash has long vines, takes much space, and is quite popular in the Caribbean. However, little research has been conducted to improve it. Many different sources of germplasm have been collected and are being tested. Some germplasm has been found that is resistant to the whitefly induced silverleaf disease. Good progress is being made toward developing a bush-type calabazas squash that takes much less space and is tolerant to powdery mildew.

National Biological Impact Assessment Program (NBIAP). Operated by Virginia Polytechnic Institute and State University with support from NBIAP, an Agricultural/Environmental Biotechnology Computer Bulletin Board was inaugurated in September 1989 with the overall goal of expediting the flow of information of biotechnology to researchers in the field. This Bulletin Board combines a monthly News Report on current developments in agricultural/environmental biotechnology with direct access to 18 databases. An E-mail capacity enabling scientists to communicate with colleagues in the field is another feature of the Bulletin Board.

The news report contains a series of brief, timely items concerning research developments, changes in legislation and regulation, international developments, and a "forum" section where issues can be debated. The databases are designed to help researchers by providing information of a spectrum of topics relevant to laboratory and field research with genetically modified organisms. The databases range from full texts of all pertinent federal regulations and guidelines to a registry of field tests conducted, current literature, state regulatory agencies, etc. The databases are continually revised and updated. The Bulletin Board is available to registered users free of charge through the toll free number: 800-NBIAP BD after an initial toll call to sign on as a user. The board operates 24 hours per day, 7 days per week. Currently, there are 6,000 registered users of the Bulletin Board.

Aquaculture. Research at Auburn University in Alabama has led to a better understanding of the genetic basis of disease resistance in channel catfish. Heritabilities and genetic correlations for resistance to a number of important diseases have been determined. This information will provide the basis for selective breeding programs aimed at improving fish health and should result in improved fish health management strategies for the farm-raised catfish industry.

Aquaculture Centers. At the Northeastern Regional Aquaculture Center (NRAC), scientists, extension specialists and private companies from Delaware, Maine, Maryland, Massachusetts, New Jersey, and Virginia are collaborating in development and testing of strains of American oysters which show improved growth and resistance to the parasitic disease, MSX. Largely because of MSX, regional oyster landings are today only one-third what they were in the 1930's. This has resulted in annual losses of millions of dollars and a doubling of oyster imports since 1970. Preliminary results of the NRAC project have been so encouraging, and industry interest so strong, that NRAC has initiated commercial field trials of the most promising strains, in cooperation with growers.

At the Southern Regional Aquaculture Center (SRAC), scientists from Alabama, Louisiana, Mississippi, North Carolina, and Texas have designed, fabricated, and evaluated a water circulator for use in catfish ponds. Daytime use of the circulator reduced the need for expensive, night-time aeration of ponds by approximately 50 percent. This could result in energy savings of up to $2 million in Mississippi alone in addition to significant savings in labor costs. The researchers also showed that using paddle wheel aerators in crawfish ponds improved water circulation and quality, increased crawfish yields, lowered pumping costs, and conserved water. SRAC scientists from Alabama, Georgia, Louisiana, Mississippi, South Carolina, Tennessee, and Texas identified and tested a crawfish harvesting trap that is 44 percent more efficient than another commonly used trap. Harvesting is the most expensive cost of crawfish for many producers, representing up to 65 percent of total production costs.

At the North Central Regional Aquaculture Center, scientists from Illinois, Iowa, Nebraska, and Wisconsin are improving breeding and culture technology for hybrid striped bass, one of the most promising U.S. aquaculture species. Reliable techniques to store, cryopreserve, and transport gametes will allow year-round production and facilitate selective breeding to improve strains.

At the Western Regional Aquaculture Center, scientists from California, Idaho, Oregon, and Washington have developed and tested a successful vaccine against the IHN Virus which affects commercial trout and salmon stocks. The disease has been identified as the most important biological constraint to the profitability and continued growth of the commercial coldwater aquaculture industry in the western U.S. Losses to the virus cost farmers millions of dollars per year. The vaccine has been commercially licensed and large scale field trials are underway.

As a result of a collaborative project supported by the Tropical and Subtropical Regional Aquaculture Center (Hawaii, Guam, American Samoa, Micronesia, Northern Mariana Islands), six previously untested therapeutant compounds needed for ensuring the health of shrimp in culture have been acquired for testing and evaluation by five pharmaceutical companies.

Crambe/Rapeseed. The High Erucic Acid Development Effort continued with significant agronomic and product development accomplishments. Crambe acreage increased from zero in 1989 to 24,000 acres in 1992 and 60,000 acres are projected in 1993. A regional economic analysis has identified geographic areas most suitable for crambe and industrial rapeseed production, plus traditional crops with which they can compete. North Dakota State University and the University of Nebraska have discovered and are refining a much more efficient process to convert erucic acid to brassylaic and pelargonic acids for manufacture of a multitude of consumer products, including the engineering nylon 1313. In addition, potential uses for glucosinolates were studied for use as an anticancer ingredient and as a natural pesticide to control nematodes.

Sustainable Agriculture Research and Education (SARE). The SARE program awards research and education grants through four regional administrative councils with farmer and rancher, non-profit private organization, agribusiness, government and academia representation. From FY 1988 through FY 1991, the program received 1,376 proposals requesting approximately $145 million. During this period, a total of 164 regional projects were funded at $17,704,000, including 21 projects funded in FY 1991 through a cooperative Agricultural in Concert with the Environment (ACE) program with the U.S. Environmental Protection Agency (EPA). The program gives highest priority to integrated system projects which deal with whole-farm system analysis. In addition to meaningful farmer or rancher volvement, most projects have both research and education components.

HIGHER EDUCATION

In FY 1992 the Department conducted three higher education programs. The National Needs Graduate Fellowships Grants Program awarded grants to colleges and universities to stimulate the development of food and agricultural scientific expertise in targeted national needs areas. The Competitive Institution Challenge Grants Program, open to all colleges and universities, provided funding to stimulate and enable colleges and universities to provide the quality of education necessary to produce graduates capable of strengthening the Nation's food and agricultural scientific and professional work force. The Morrill-Nelson Permanent Appropriation provided approximately $50,000 to every State and territory to advance the quality of teaching programs in the food and agricultural sciences at land-grant universities.

CURRENT ACTIVITIES

In FY 1992, funds were appropriated to support 63 new doctoral fellows through the USDA National Needs Graduate Fellowships Grants Program. This is the only Federal program targeted specifically to the recruitment and training of predoctoral students for critical food and agricultural scientific positions. It represents a national investment strategy to attract diverse and talented U. S. students to pursue advanced degrees in the food and agricultural sciences. Master's enrollments decreased steadily through the 1980's and appear to have stabilized at around 10,000. Although fairly stable, doctoral enrollments remain at less than 10,000. Further, projections on the availability of experise in the food and agricultural sciences suggest shortfalls in several employment categories.

Fiscal year 1992 was the second year funds were available for the Competitive Institution Challenge Grants Program. Supported projects address regional, national, or international higher education issues; involve creative and novel approaches to teaching that can serve as models; and foster partnership initiatives across the university science and education community, as well as between universities and the private sector. The program requires dollar-for-dollar nonfederal matching funds.

Legislative authority for the administration of funds appropriated pursuant to Morrill-Nelson legislation was transferred to the U. S. Department of Agriculture and targeted to the food and agricultural sciences by the Food and Agriculture Act of 1981. The program was formerly administered by the Department of Education and is considered a permanent appropriation.

SELECTED EXAMPLES OF RECENT PROGRESS

National Needs Graduate Fellowships Grants

Approximately $3.4 million were available in fiscal year 1992 to fund the National Needs Graduate Fellowships Grants Program. New grants were awarded to colleges and universities to support 63 new doctoral fellows in three targeted national needs areas (Biotechnology-Animal; Human Nutrition and/or Food Science; and Marketing or Management-Food, Forest Products, or Agribusiness).

The new doctoral fellows supported via FY 1992 grants are presently being recruited and can thus be expected to graduate mid to late 1997. The recruitment and training of outstanding doctoral scientists requires considerable time. This fellowship program helps to minimize these lengthy time requirements by readily attracting academically outstanding students and by enabling them to pursue full-time graduate studies and complete their degree programs as quickly as possible.

Competitive Institution Challenge Grants Program

In FY 1992, approximately $1.4 million were available under the Competitive Institution Challenge Grants Program to support projects which addressed the undergraduate level of study in the following targeted need areas: (1) curricula design and materials development; (2) faculty preparation and teaching enhancement; (3) instruction delivery systems; and (4) student experiential learning. A total of 67 different institutions submitted 131 proposals for funding consideration. Funds were available to support a total of 25 grants based on peer review deliberations. The 25 grants were awarded to 17 institutions in 16 states. Five of the projects supported with FY 1992 funds will develop interactive, computer-based, autotutorials to be used in teaching specific content such as environmental issues, international awareness, microbiology as it applies to agriculture, human nutrition, and dairy cattle body condition scoring. Other supported projects address the case study approach to teaching, undergraduate student research, international internships for undergraduates, and incorporating environmental and natural resource management into the undergraduate curriculum.

Morrill-Nelson

The latest data available denotes use of Morrill-Nelson funds for faculty salaries, teaching equipment, program development and other operating expenses. Administrative units having access to and reporting use of the[illegible]es to strengthen higher education in the food and agricultural scie[illegible] include agriculture, home economics, forestry, and veterinary medicine.

NATIONAL RESEARCH INITIATIVE COMPETITIVE GRANTS PROGRAM

The original Competitive Research Grants program was initiated by the Department in 1978 to fund basic research in selected high priority areas related to plant production and human nutrition. Basic research initiatives implemented in 1985 encompassed broader research perspectives in plant and animal science and biotechnology. Competitive research grants have complemented the on-going research efforts of the USDA and the traditional agricultural research arena by encouraging the participation of outstanding research scientists throughout the entire U.S. scientific community who have expertise in these areas.

In FY 1991, the Competitive Research Grants Program was expanded into the National Research Initiative (NRI). Research areas were added in natural resources and the environment; plant systems; animal systems; and nutrition, food quality and health. In FY 1992, two new areas of processing antecedent to adding value to new products and markets, trade and policy were added to the National Research Initiative. The following is a description of current activities and selected examples of accomplishments supported under this appropriation item.

<u>CURRENT ACTIVITIES</u>

The NRI target areas were identified as those with a high potential for scientific discoveries that will contribute to vitally needed solutions of important agricultural problems. Target areas in natural resources and the environment include water quality, plant responses to the environment, forest/rangeland/crop ecosystems, and improved utilization of wood and wood fiber. The target areas in nutrition, food quality and health address the research area of human nutrient requirements for optimal health and food safety. There are four target areas in animal systems research: reproductive biology, cellular growth and developmental biology, animal molecular genetics and gene mapping, and mechanisms of animal disease. In plant systems the target areas

encompass: plant-pest interactions (e.g., pathogens, weeds, insects and nematodes), plant genome, genetic mechanisms and molecular biology, photosynthesis and respiration, and nitrogen fixation/metabolism. Research on alcohol fuels is also supported.

The National Research Initiative Competitive Grants Program received 2,911 research proposals in FY 1992 requesting $597 million for support of research in the targeted areas. From those proposals 777 grants were awarded totaling $92.1 million. Table 6 provides details on the number of proposals submitted, the number of grants awarded, and the major categories of grant organizations. Table 7 lists recipients of competitive research grants and the dollars received.

SELECTED EXAMPLES OF RECENT PROGRESS

PLANT SYSTEMS

Genetic Mechanisms. In addition to being the major fiber crop worldwide, cotton is the world's second oilseed crop, worth $500 million annually in the U.S. Cotton is also the largest single commodity in the U.S. for insecticide use with over 15 million pounds applied yearly. One unique physical feature of cotton is the presence of dark pigmentation structures, called pigment glands, throughout the plant parts. These glands are of major economic significance since glands on the seed limit cottonseed's food and feed use, while glands on leaves and flowers help to repel many insect pests. Researchers in Texas are attempting to better understand the genes that control gland formation. Specifically, they are attempting to determine the location of genes on specific chromosomes, and to detect any chemical changes that would influence insect resistance to the budworm, one of the most important pests repelled by the gland's natural chemicals. Advanced image analysis techniques that interface computer with the microscope is employed in the research, as are genetic, molecular biological and chemical approaches. This increased understanding of glanding genes could increase the value of cottonseed and reduce high amounts of insecticide application which is economically and environmentally undesirable.

Plant Growth and Development. In many temperate zone fruit trees, including apples, heavy cropping can inhibit flowering the following year, resulting in biennial bearing; that is, abundant crops one year followed by poor crops the next. However, seedless fruits do not affect flowering, indicating that the seeds are responsible for this inhibition. Seeds produce gibberellins--naturally occurring plant hormones that are known to inhibit flowering in woody plants. Although biennial bearing of some apple varieties can be reduced by applying chemicals that remove a portion of the crop (thinning), this response varies with the variety of apple, some being more difficult to thin. Weather conditions can also reduce effectiveness. Furthermore, environmental concerns could prevent the use of these synthetic chemicals. Researchers at Michigan State University will determine whether seed gibberellins are indeed responsible for the inhibitory effect of the fruit on flowering. Both seeded and seedless apple fruits will be used to determine how seeds affect the metabolism of gibberellins. The study can provide new leads as to how a naturally occurring plant hormone might be used to either enhance flowering when the crop is small, or to inhibit it when the crop is excessive.

Plant Genome. Genetic engineering of desirable traits offers great potential. One of the roadblocks to its use, however, has been the concern regarding possible introduction of undesirable genes along with the desired gene. Usually two genes are introduced together into an organism - the desired gene and a marker gene used to identify or "select" the successfully "transformed" organism. Often antibiotic-resistance or herbicide-resistance genes are used to select for transformation. Once the modified organism has been identified, the

marker gene is no longer needed. While its presence is not necessarily harmful, it may cause uncertainty with regard to environmental impact and consumer acceptance and have a negative effect on using the biotechnology for improvement. Scientists at the Plant Gene Expression Center, Agricultural Research Service, Albany, California have made major progress on how to overcome this roadblock. They have found a way to make the transformed organism snip out the marker gene, but leave the desired new gene in the organism. The technique was developed using tobacco cells, but it can be applied to other organisms such as bacteria, yeast and mammalian cells and could potentially be used in human gene therapy.

Plant-Pathogen Interactions. The mechanism by which bacteria cause disease in plants has been an area of major research emphasis for many years. Researchers at Cornell University in New York have found a protein that they named "harpin" that will elicit the plant defense response known as the hypersensitive reaction. Harpin was isolated from the bacterium that causes fire blight of pears and apples, a major destructive parasite of these fruit trees. In addition, harpin seems to be responsible for the localized collapse of leaf tissue and is required for the development of the disease. This is a major advance in our understanding of how a bacterium causes a specific adverse reaction in plants and use of the protein may aid in development of procedures to evaluate resistance.

Entomology/Nematology. A crucial question in the development of plants resistant to insect pests is whether to breed crop cultivars with low, moderate or very high levels of resistance. While high levels of resistance are generally desirable for short-term control, the optimal approach for long-term crop protection is not clear because of the potential for the pest to develop resistance to the plant's chemical defense. A number of entomologists have suggested that low or moderate levels of insect-pest resistance, coupled with the action of natural enemies, will provide significant pest suppression without causing intense selection for pest adaptation to the resistance. Although this is an appealing assertion, it has never been rigorously tested. Investigators at North Carolina State University are conducting experiments with the Colorado potato beetle, one of the most important pests on potatoes and other crops. Initial results have indicated that natural enemies could increase, decrease or not affect the rate at which a herbivore population adapts to a resistant host depending at which stage of growth of the host that the parasite attacks. With the advent of genetic engineering techniques, the choice between partial and strong resistance has become a timely and practical approach for analysis of the variables involved.

ANIMAL SYSTEMS

Cellular Growth and Developmental Biology of Animals . Understanding muscle growth is critical to producing high quality, nutritious meat. Investigators at Oregon State University are studying muscle growth by investigating factors which affect muscle breakdown or degradation, such as aging. They have determined that the activity of calpain, a key enzyme in muscle protein breakdown, decreases with age, which may account for age-related changes in muscle growth. Another group of scientists at the University of Arizona have demonstrated that calpain works to break down muscle tissue by releasing a specific type of fiber from the muscle. These studies contribute to our understanding of how muscle protein forms during growth of meat animals.

Animal Molecular Genetics. The U.S. consumer is demanding leaner meat products. Researchers at the University of Iowa are targeting fat regulatory genes to the chicken liver in the hope that they will be expressed because fat deposition and biochemistry is primarily regulated in the liver. To date, the gencs have been

selectively taken up by the liver in living chickens, but the genes have not been appropriately expressed due to the action of other enzymes in the chicken liver. Further experiments are under way to eliminate this problem. In other studies at the University of Illinois, investigators have a major gene mapping project underway to identify gene segments associated with increased litter number and increased growth of muscle in pigs. To date, at least one gene family in each area has been identified and mapped. This could lead to selection and breeding of leaner pigs and therefore leaner pork.

Mechanisms Of Animal Disease. Brucellosis is a bacterial disease causing over $250 million in losses per year to the U.S. cattle industry. Researchers at the University of Wisconsin are studying the immune response to these intracellular bacteria. They have identified the bacterial gene that is responsible for causing white blood cells to divide in response to infection by the bacteria. Further work will be necessary to determine whether this natural product can be used rather than the current vaccine.

Reproductive Biology of Animals. Pregnancy loss in cattle due to the ingestion of Ponderosa Pine needles is a major economic problem in the Western U.S. Investigators at Iowa State University have demonstrated that when cows eat pine needles it causes a decrease in blood flow to the placenta because of a constriction of blood vessels. This results in premature birth. These scientists have made significant progress in the isolation and purification of the substance in pine needles that causes blood vessels to constrict. This research could lead to an effective treatment against pine needle toxicity.

NUTRITION, FOOD QUALITY AND HEALTH

Human Nutrient Requirements for Optimal Health. Researchers at the University of Missouri are investigating how Vitamin E and fish oils (omega-3 fatty acids) may interact to enhance the immune system. Their studies have shown that antibody production is elevated in animals fed diets containing fish oil and Vitamin E. Additional studies are underway to further investigate the potential interacting role of fish oil and Vitamin E in boosting the immune system.

Food Safety. There are 250 million cases of food poisoning per year in the United States. As consumers demand more minimally processed foods that are convenient to use, it is feared that the number of cases will increase. Nisin, a protein produced by bacteria involved in fermentation, is used by the food and dairy industries as a preservative. Scientists at Rutgers University in New Jersey are studying nisin to learn how it inhibits the growth of food pathogens such as Clostridium botulinum, the cause of botulism, and Listeria monocytogenes, the cause of listeriosis. This research may eventually make the U.S. food supply safer for consumers.

NATURAL RESOURCES AND ENVIRONMENT

Plant Response to the Environment. Drought and salinity are the two most significant stresses affecting plant growth and productivity. A major roadblock in developing plants tolerant to these and other stresses by either traditional breeding or gene transfer methods is that the mechanisms which can confer tolerance are complex and as yet largely uncharacterized. Among the mechanisms that some plants and microbes have evolved in adapting to water deficit and high salinity is the accumulation of high intracellular levels of the amino acid proline. Scientists at Ohio State University recently: 1) established the biosynthetic pathway for this amino acid in soybean and mothbean; 2) determined some of the regulatory properties of the key enzyme involved; 3) isolated all of the genes involved in the pathway from glutamate; 4) and showed that the expression of the genes increased in salt-treated roots. To determine whether

the ability of plants to accumulate proline can be controlled and whether such accumulation can confer tolerance to species which are susceptible to drought and salinity will next be studied by introducing the genes -- with appropriate modifications in regulatory properties -- into such plants.

Forest/Rangeland/Crop Ecosystems. Even-aged management (for example, clearcut harvesting) is the most widely used silvicultural system in North America because of its efficiency and promotion of desirable tree species. Stand development following large-scale disturbances like clearcut harvesting has been a subject of great interest to forest scientists and managers hoping to understand forest dynamics and to maximize the growth and value of stands. In many forest ecosystems, the initial stage of stand development is dominated by one or more fast-growing, pioneer species which are subsequently replaced by slower-growing, understory tolerant trees. Although this type of successional sequence has been well documented, the actual mechanisms regulating the transfer of dominance from pioneer to mature forest species has received little attention. Researchers at Cornell University in New York are examining ecological organization within the ecosystems and how these connections influence the successional process in northern hardwood forests of the northeastern United States. They have determined that pin cherry, which grows rapidly in clearcut areas, eventually declines after other slow-growing species get larger and close the canopy. The nature of the transition from pin cherry dominance to mature hardwoods depends upon both the particular mix of species present initially as well as their response to the changing resource availability. The investigators are proposing that succession following large-scale disturbance in northern hardwoods provides a representative model system for improving conceptual understanding of competition and vegetation development in multi-species communities. This information is to be placed in a succession model, one which will be useful for forest managers who must successfully regenerate forests after clearcutting.

Global Change. There is the potential for the amount of ultraviolet radiation to increase at the earth's surface as a result of stratospheric ozone reduction. Because of the possibility that agriculture, in particular, could be adversely affected by UV-B radiation, USDA/CSRS has the lead in a program to accumulate reliable and scientifically accurate data on the levels of UV-B radiation that actually strike the earth's surface over the long term. This objective can only be achieved if the appropriate instruments are available. Scientists at the State University of New York at Albany have developed a high resolution UV-B spectroradiometer to be used for intense measurement of UV-B at selected field sites and as the standard instrument against which other lower-resolution instruments will be calibrated. The high resolution spectroradiometer will undergo extensive tests at the National Institute of Standards and Technology before being deployed in early 1993.

PROCESSING FOR VALUE ADDED

Processing. The goal of this program initiated in FY 1992 is to provide improved processes and products that will increase the utilization of agricultural materials and enhance their competitive value and quality. Scientists at the University of Illinois will be using magnetic resonance imaging to study moisture and temperature gradients in materials such as food and grain during drying to design more efficient processes and processing equipment. Research at the University of California, Davis will model the loss of moisture and the absorption of fat during the frying process to design more efficient frying processes and more acceptable and healthful foods.

Scientists at Kansas State University are developing polymer-hide composite materials, adding value to a renewable and currently under-utilized agricultural by-product. They are investigating how to insert synthetic polymers such as epoxide resins into hide and determining the properties of the resulting composite material. Since such a material takes advantage of the properties of both the polymer and of leather, the research has the potential to broaden the market for leather as a raw material.

MARKETS, TRADE AND POLICY

Markets, Trade and Policy . This program was initiated in FY 1992 and its mission is to support innovative and applied socioeconomic research to (a) improve the competitiveness of U.S. agriculture, fish and forest products in global markets and (b) enhance the well-being of rural America. Competitiveness research includes assessments of markets for U.S. products; studies to evaluate the ability of the U.S. to compete in markets; and assessments of the benefits, risks and costs of new sustainable technologies to enhance trade and protect the environment. Researchers at Purdue University in Indiana will examine the effectiveness of alternative modes of selling processed foods in overseas markets. Rural development research includes examination of public policies and alternatives for their impacts on the structure of rural society, natural resource use, and population distribution. Research at Clemson University in South Carolina will identify factors characteristic of metropolitan areas that spill over and promote or inhibit economic growth in surrounding rural areas.

SMALL BUSINESS INNOVATION RESEARCH PROGRAM

The Small Business Innovation Development Act (SBIR), Public Law 97-219, July 22, 1982, as amended by Public Law 99-443, October 6, 1986, was designed to strengthen the role of small, innovative firms in Federally funded research and development. Under this program small firms receive at least a fixed minimum percentage of research and development awards made by Federal agencies with sizable research and development budgets. From FY 1986 through FY 1992, 1.25 percent of an agency's extramural research budget was set aside for purposes of the SBIR Act. The Small Business Research and Development Enhancement Act of 1992 (Public Law 102-564, October 28, 1992) has amended the set-aside percent for the SBIR program as follows: 1.5 percent in fiscal years 1993 and 1994, 2.0 percent in fiscal years 1995 and 1996, and 2.5 percent in each fiscal year thereafter.

The objectives of the Small Business Innovation Research program include stimulating technological innovation in the private sector, strengthening the role of small businesses in meeting Federal research and development needs, increasing private sector commercialization of innovations derived from USDA-supported research and development efforts, and fostering and encouraging participation by minority and disadvantaged small business firms in technological innovation.

The following is a description of current activities and selected examples of accomplishments from this program.

CURRENT ACTIVITIES

In response to the September 1, 1991, deadline announced in the Federal Register, the Department of Agriculture received 346 Phase I proposals from small businesses that had innovative approaches to solve problems in U.S. agriculture. On February 15, 1992, 30 Phase II proposals were submitted by small businesses that had previously received Phase I awards. The agency contributions were pooled and grants were made without regard to the funding

source. The proposals were peer reviewed and many high quality applications were identified. With the funds available for the program 63 awards (44 Phase I awards and 19 Phase II awards) could be made. A summary for fiscal year 1992 follows:

Program Area	Number of Proposals Received	Amount Requested	Number of Grants Awarded	Amount of Awards
Forest and Related Resources	33	$2,877,417	7	$673,752
Plant Production and Protection .	92	6,238,970	15	1,686,876
Animal Production and Protection.	46	2,789,639	7	513,816
Air, Water and Soils	44	3,010,288	7	469,367
Food Science and Nutrition	27	1,827,965	4	309,800
Rural and Community Development .	55	3,492,149	9	819,068
Aquaculture	45	2,535,714	8	534,930
Industrial Applications	34	2,064,143	6	619,894
Total	376	24,836,285	63	5,627,503

SELECTED EXAMPLES OF RECENT PROGRESS

Forests and Related Resources. Effective firefighting often requires the use of aerial tankers. A major challenge concerning the aerial application of fire retardants is to achieve the optimum placement and coverage for the type of fuel and terrain in which the fire is burning. Current aerial retardant application systems lack the capability to accurately obtain consistent placement and coverage in the field because they fail to make corrections for altitude, crosswinds, acceleration, and ground speed. A Wyoming company is using a computer-controlled retardant flow rate system to compensate for altitude, crosswinds, acceleration and ground speed in order to achieve more accurate placement and coverage of fire retardants on wildfires. Successful implementation of this system will save millions of dollars in property and forest resources through more effective use of aerial application of fire retardants.

Plant Production and Protection. Plant losses to various diseases result in substantial decreases in crop yields each year. Some of the most serious plant pathogens are soil fungi that attack young plant seedlings. Many of the fungi contain chitin in their cell walls. Thus, if plants could be engineered to produce the enzyme chitinase, which degrades chitin, it should increase their resistance to fungal attack. A California company has isolated two chitinase genes from a soil bacterium and introduced them into tobacco. The resulting transgenic plants exhibit substantially improved resistance to the soil pathogen, *Rhizoctonia solani*. The chitinase genes can also be introduced into many other plants to confer resistance to *Rhizoctonia* and possibly other soil fungi as well. This application of biotechnology to improving plant disease resistance promises to result in substantial savings due to reduced losses caused by *Rhizoctonia* and other soil fungi.

Animal Production and Protection. Improved management of cattle reproduction is an important objective of the animal industry. Superovulation of superior cows to obtain multiple ova that can be fertilized and implanted in surrogate cows is an important goal. Presently this can only be accomplished by multiple injections of bovine follicle stimulating hormone (bFSH) over a four day period. This procedure is very labor intensive and is not practical if more than a few cows are to be treated. A Massachusetts company has developed a multiphasic controlled release hormone delivery system for improved cattle reproduction management. With this system only one injection is necessary and then pulses of bFSH are delivered at 4-8 hour intervals from the implant over a four day period. This system greatly saves on labor costs and promises to make superovulation of cows more effective and much less expensive.

Air, Water and Soils. A subject of major concern to American agriculture is the impact of different farming practices on soil erosion and water quality. Intensive farming that utilizes large inputs of fertilizers and extensive irrigation often results in accelerated soil erosion and contamination of surface and ground water through runoff of excess fertilizer. An Oregon company has developed a procedure for using mechanical straw mulching to greatly reduce the amount of irrigation runoff water, and this leads to a reduction in soil erosion and a large reduction in the amount of phosphorous and other nutrients that are lost to surface waters. The use of mechanical straw mulching will lead to a more sustainable farming system that has a greatly reduced adverse impact on soil erosion and water quality.

Food Science and Nutrition. Maintaining high standards of food quality is of great importance to the food industry. Food items can be contaminated in a number of different ways by a variety of different substances. The challenge is to design effective methods to detect food contaminants. A Louisiana company has developed small, accurate fiber-optic biosensors (optrodes) for use on agricultural and food products. These optrodes are low cost and reproducibly measure a variety of food constituents and contaminants with high sensitivity and specificity. Because the optrodes are small and light, they have a unique potential for remote sensing. These biosensors will have a significant impact on the food industry.

Rural and Community Development. The availability of 911 service is taken for granted in urban areas, but less than 25 percent of rural areas have 911 service. In regular 911 service the incoming call provides no information about the location of the caller, which can be a problem if the caller is a small child or is incapacitated. With enhanced 911 (E911) service, however, the incoming call carries information on the specific location of the call. The major impediment to making E911 service available in rural areas is the high cost of the tandem switches used by the major phone companies to provide E911 service. A Minnesota company has designed a much smaller and cheaper tandem switch that is suitable for use in rural areas. They are also developing a system that will identify the caller's location, even when the caller is part of a party line. This technology will make it possible to provide E911 service to many rural areas that presently lack any type of 911 service and to upgradeexisting regular 911 service to E911 service. With implementation of E911 service, rural residents will have the same access to emergency services that currently exists in most urban areas and this will improve the quality of services available to rural Americans.

Aquaculture. In recent years there has been an overall reduction in oyster production in this country, due substantially to the drastic reduction in harvest of *Crassostrea virginica* from the Chesapeake Bay and elsewhere. One way to compensate for the decrease in oyster harvests is to raise oysters in intensive aquaculture facilities. A Hawaii company is developing an integrated oyster and shrimp production system where shrimp pond effluent is used to feed the oyster *C. virginica*, which is grown with fluidized bed technology. In this intensive aquaculture system both oysters and shrimp will be harvested commercially. The system will also produce substantial amounts of algae, which will be the food source for the oysters. It is projected that this integrated system will produce oysters much quicker than in natural waters and the oysters will be healthier and less prone to disease. Young oysters produced in this system can also be used to repopulate the depleted oyster beds in the Chesapeake Bay and elsewhere. Thus, this system offers the potential of a new source of disease-free oysters at a competitive price and also the potential to help restore natural oyster stocks.

Industrial Applications. Castor oil is currently used in many cosmetic applications. Virtually all castor oil is imported and thus efforts are being made to identify a domestic alternative to castor oil. *Lesquerella fendleri* grows well in the arid southwest and oil produced from its seed has a unique composition that makes it a potential substitute for castor oil. An Arizona company has prepared a highly refined grade of lesquerella oil suitable for use in cosmetic applications. They are preparing various chemical derivatives that will be used to prepare different cosmetic products such as lipstick and stick deodorant. Successful development of value-added products from lesquerella oil for use in the cosmetic industry will lead to the establishment of *L. fendleri* as an important new arid land crop that will provide a new cash crop for farmers in the southwest.

COOPERATIVE STATE RESEARCH SERVICE

The estimates include proposed changes in the language of this item as follows (new language underscored; deleted matter enclosed in brackets):

[Buildings and Facilities:]

[For acquisition of land, construction, repair, improvement, extension, alteration, and purchase of fixed equipment or facilities and for grants to States and other eligible recipients for such purposes, as necessary to carry out the agricultural research, extension, and teaching programs of the Department of Agriculture, where not otherwise provided, $52,101,000, to remain available until expended (7 U.S.C. 2209b).]

No funding is proposed for this program in fiscal year 1994.

COOPERATIVE STATE RESEARCH SERVICE

BUILDINGS AND FACILITIES

Appropriations Act, 1993	$52,101,000
Budget Estimate, 1994	- -
Decrease in Appropriations	-52,101,000

SUMMARY OF DECREASE

Item of Change	1993 Estimated	Program Change	1994 Estimated
Buildings and Facilities	$52,101,000	-$52,101,000	- -

PROJECT STATEMENT
(On basis of appropriation)

Project	1992 Actual Amount	Staff-Years	1993 Estimated Amount	Staff-Years	Increase or Decrease	1994 Estimated Amount	Staff-Years
ALABAMA:							
Wallace State Junior College Wellness Center	- -		(a)		- -	- -	
ARIZONA:							
Agric. Research Complex-Envir. Stress Lab. University of Arizona, Tucson ...	$100,000		$1,100,000		-$1,000,000	- -	
ARKANSAS:							
Ctr. for Alter. Pest Control Research, Univ. of Arkansas .	500,000		- -		- -	- -	
Poultry Center for Excellence, Univ. of Arkansas	3,050,000		3,189,000		-3,189,000	- -	
Poultry Laboratory & Isolation Facility, Univ. of Arkansas .	250,000		- -		- -	- -	
Livestock Research & Activity Complex ..	- -		(a)		- -	- -	
CALIFORNIA:							
Altern. Pest Control Containment and Quarantine Fac., Univ. of CA., Davis	- -		385,000		-385,000	- -	
Grape Import. Facil. Univ. of CA., Davis	- -		2,191,000		-2,191,000	- -	
COLORADO:							
Animal Reproduction Biotechnology, Colorado State Univ.	- -		(a)		- -	- -	
DELAWARE:							
Poultry Biocontainment Laboratory	- -		(a)		- -	- -	
FLORIDA:							
Ag. Biotech. Inst., Univ. of Florida ..	840,000		276,000		-276,000	- -	
GEORGIA:							
Biocontainment Facil. Univ. of Georgia ..	425,000		- -		- -	- -	
Ctr. for Advanced Water Technology, Savannah State College	136,000		376,000		-376,000	- -	
Nat. Lab. for Envir. Sound Prod. Ag., Univ. of GA., Tifton	1,775,000		1,293,000		-1,293,000	- -	
Vidalia Onion Storage Research Facility, Univ. of GA., Tifton	225,000		194,000		-194,000	- -	
Ag. Livestock and Poultry Facil., Univ. of GA., Athens	(a)		- -		- -	- -	
Center for Rural Health & Epidemiology, Georgia Southern University	- -		(a)		- -	- -	
HAWAII:							
Ctr. for Tropical & Subtropical Agric., Univ. of Hawaii ...	3,842,000		3,311,000		-3,311,000	- -	

Project	1992 Actual Amount	1992 Actual Staff Years	1993 Estimated Amount	1993 Estimated Staff Years	Increase or Decrease	1994 Estimated Amount	1994 Estimated Staff Years
IDAHO:							
Biotech. Facility, Univ. of Idaho	- -		$931,000		-$931,000	- -	
ILLINOIS:							
Biotech. Center, Northwestern Univ..	$600,000		517,000		-517,000	- -	
National Soybean Lab., Univ. of Illinois .	1,987,000		- -		- -	- -	
INDIANA:							
Molecular & Cellular Biotech. Facility, Indiana University	2,750,000		2,155,000		-2,155,000	- -	
IOWA:							
Trade Marketing Center	- -		(a)		- -	- -	
KANSAS:							
Plant Science Ctr., Kansas State Univ.	1,570,000		1,353,000		-1,353,000	- -	
LOUISIANA:							
Fish Processing Facility	- -		(a)		- -	- -	
Red Meat Processing Facility	- -		(a)		- -	- -	
MAINE:							
Presque Isle Farm Bldg. Consolidation, University of Maine	150,000		776,000		-776,000	- -	
Wood Processing Facilities	- -		(a)		- -	- -	
MARYLAND:							
Institute for Nat. Resources & Envir. Science, Univ. of Maryland	1,000,000		862,000		-862,000	- -	
MASSACHUSETTS:							
Center for Hunger, Poverty, Nutrition & Policy, Tufts Univ.	- -		1,046,000		-1,046,000	- -	
MICHIGAN:							
Food Toxicology Ctr.., Michigan State Univ.	5,076,000		15,010,000		-15,010,000	- -	
MISSISSIPPI:							
Biological Technology Ctr. for Water and Resources, Univ. of Mississippi	- -		186,000		-186,000	- -	
MISSOURI:							
Bennett Living and Learning Center, Lincoln Univ.......	145,000		- -		- -	- -	
Meat Science & Safety Center	- -		(a)		- -	- -	
Bioscience Research Ctr., U. of Missouri	- -		(a)		- -	- -	
MONTANA:							
Bioscience Center, Montana State Univ.	1,062,000		915,000		-915,000	- -	
NEBRASKA:							
Ctr for Advan. Tech. Univ. of Nebraska .	4,500,000		- -		- -	- -	
NEVADA:							
Biochemistry and Biology Field Research Station, Univ. of Nevada ...	250,000		215,000		-215,000	- -	

Project	1992 Actual Amount	1992 Actual Staff-Years	1993 Estimated Amount	1993 Estimated Staff-Years	Increase or Decrease	1994 Estimated Amount	1994 Estimated Staff Years
NEW JERSEY:							
Plant Bioscience Fac., Rutgers Univ.	$3,044,000		$2,623,000		-$2,623,000	- -	
NEW MEXICO:							
Center for Arid Land Studies, New Mexico State University ..	- -		(a)		- -	- -	
NEW YORK:							
New York Botanical Garden	1,350,000		3,697,000		-3,697,000	- -	
Cornell Univ., Research Greenhouse .	375,000		375,000		-375,000	- -	
NORTH CAROLINA:							
Biotech. Facility ..	1,450,000		- -		- -	- -	
Ctr. for Nutrition, Wake Forest Univ...	1,825,000		3,684,000		-3,684,000	- -	
NORTH DAKOTA:							
Animal Care Fac., ND State Univ......	250,000		- -		- -	- -	
Engineering and Biomechanics Bldg., ND State Univ.........	(a)		- -		- -	- -	
Food Processing Pilot Plant, ND State Univ	- -		750,000		-750,000	- -	
Facilities Completion, ND State Univ......	(b)		- -		- -	- -	
Institute for Agric. and Rural Health Research Dev., Minot State Univ.........	- -		2,179,000		-2,179,000	- -	
Inst/Ag Health Science and Rural Medicine, Univ. of North Dakota	4,381,000		1,864,000		-1,864,000	- -	
Seed Research and Regulatory Facility, ND State University	500,000		431,000		-431,000	- -	
OHIO:							
Plant Science Research Facility, Univ. of Toledo ...	- -		512,000		-512,000	- -	
Lake Erie Soil & Water Research and Education Center ..	- -		(a)		- -	- -	
OKLAHOMA:							
National Ctr. for Bovine/Equine Biotech. Oklahoma State Univ...............	225,000		- -		- -	- -	
Beef Cattle Research Facility	- -		(a)		- -	- -	
OREGON:							
Seafood Center, Oregon State Univ..	217,000		1,824,000		-1,824,000	- -	
Regional Food Innovation Ctr., Oregon State Univ..	(a)		- -		- -	- -	
PENNSYLVANIA:							
Center for Food Marketing, St. Joseph's University	- -		5,046,000		-5,046,000	- -	
RHODE ISLAND:							
Bldg. Consolidation, Univ. of RI	500,000		431,000		-431,000	- -	

Project	1992 Actual Amount	1992 Actual Staff-Years	1993 Estimated Amount	1993 Estimated Staff-Years	Increase or Decrease	1994 Estimated Amount	1994 Estimated Staff Years
SOUTH DAKOTA:							
No. Plains Biostress Lab., SD State Univ.	$1,515,000		$875,000		-$875,000	- -	
TENNESSEE:							
Nursery Crop Research Station, Tennessee State University ..	426,000		367,000		-367,000	- -	
Ag., Biological and Envir. Research Complex, Univ. of Tennessee, Knoxville	925,000		797,000		-797,000	- -	
Horticulture Public Service Research & Education Center, Middle Tennessee State University ..	- -		(a)		- -	- -	
TEXAS:							
Inst. of Biosciences & Technology, Texas A&M Univ. at Houston	3,860,000		603,000		-603,000	- -	
Southern Crop Improvement, Texas A&M	- -		(a)		- -	- -	
UTAH:							
Biotech Lab, Utah State University ..	764,000		658,000		-658,000	- -	
VIRGINIA:							
Agric. Biotechnology Facility, Virginia Polytechnic Inst. & State University ..	1,021,000		880,000		-880,000	- -	
WASHINGTON:							
College of Veterinary Medicine, Animal Disease Biotech Fac. WA State Univ......	2,120,000		2,258,000		-2,258,000	- -	
WISCONSIN:							
Agric. Biotech/ Genetics Fac., Univ. of Wisconsin	7,393,000		2,161,000		-2,161,000	- -	
College of Natural Resources, Univ. of Wisconsin, Stephens Point	(a)		86,000		-86,000	- -	
WYOMING:							
Envir. Simulation Fac., Univ. of WY	500,000		431,000		-431,000	- -	
Reports on footnote (a) items	150,000		260,000		-260,000	- -	
Carryover Balances ..	5,000		- -		- -	- -	
Federal Admin. (3%) .	(1,891,220)		(2,064,390)		(-2,064,390)	- -	
Total obligations ..	63,029,000	10	69,073,000	- -	-69,073,000	- -	
Unobligated Balances:							
Available, start of year	-5,231,000		-16,972,000		+16,972,000	- -	
Available, end of year	+16,972,000		- -		- -	- -	
Total appropriation ...	74,770,000	10	52,101,000	10	-52,101,000 (1)	- -	- -

(a) Funds were provided to the Cooperative State Research Service for the purpose of reporting to Congress on the need for this facility. Actual funds are not earmarked for award to the institution.

(b) Funds were rescinded for North Dakota State University Facilities Completion project totaling $500,000 per P.L. 102-298.

EXPLANATION OF PROGRAM

In the Fiscal Year 1993 Appropriations Act, $52.1 million was appropriated to CSRS for Buildings and Facilities at designated institutions. These funds are available until expended and CSRS is awarding grants for these facilities to the institutions.

JUSTIFICATION OF DECREASE

(1) A decrease of $52,101,000 for Buildings and Facilities ($52,101,000 available in 1993).

Need for Change. These funds were earmarked for facilities at specific institutions in 1993. Keeping with the Administration's policy of awarding research and construction grants through a competitive, peer-reviewed process, no additional Federal funding is being proposed in 1994.

Cooperative State Research Service
Status of Buildings and Facilities

The status of CSRS-supported buildings and facilities is as follows:

Location and Facility	Year and Purpose	Funds Provided	Description
G. C. Wallace State Community College, Hanceville, AL Wellness Center	1993 Report	(a)	Preliminary estimates received. Study to be conducted by CSRS in second quarter of FY 1993 to determine need for facility.
University of Arizona, Tucson Environmental Stress Laboratory	1991 Report	(a)	Design work underway.
	1992 Planning and Construction	100,000	
	1993 Construction	1,100,000	
	Total	1,200,000	
University of Arkansas, Fayetteville Center for Alternative Pest Control Research	1990 Construction	420,000	Design complete. Construction underway.
	1991 Construction	811,000	
	1992 Construction	500,000	
	Total	1,731,000	
University of Arkansas, Fayetteville Livestock Research and Activity Complex	1993 Report	(a)	Preliminary estimates received. Study to be conducted by CSRS in second quarter of FY 1993 to determine need for facility.
University of Arkansas, Fayetteville Poultry Center for Excellence	1990 Report	(a)	Construction underway.
	1991 Planning and Construction	3,750,000	
	1992 Construction	3,050,000	
	1993 Construction	3,189,000	
	Total	9,989,000	

Location and Facility	Year and Purpose	Funds Provided	Description
University of Arkansas, Fayetteville Poultry Laboratory and Isolation Facility	1988 Construction	375,000	Construction nearing completion.
	1989 Construction	200,000	
	1990 Construction	247,000	
	1991 Construction	337,000	
	1992 Construction	250,000	
	Total	1,409,000	
University of California, Davis/Riverside Alternative Pest Control Containment and Quarantine Facility	1991 Report	(a)	Planning begun in fourth quarter of FY 1991 and is continuing.
	1992 Planning and Construction	207,000 (b)	
	1993 Construction	178,000	
	Total	385,000	
University of California, Davis Grape Importation and Clean Stock Facility	1990 Planning	128,000	Phase I completed. Phase II architectural work completed and construction underway. Planning underway for Phase III.
	1991 Planning and Construction	897,000	
	1992 Construction	1,609,000 (b)	
	1993 Construction	582,000	
	Total	3,216,000	
Colorado State University, Fort Collins Animal Reproduction and Biotechnology Facility	1993 Report	(a)	Preliminary estimates received. Study to be conducted by CSRS in second quarter of FY 1993 to determine necessity of facility.
University of Delaware, Newark Poultry Biocontainment Laboratory	1993 Report	(a)	Preliminary estimates received. Study to be conducted by CSRS in second quarter of FY 1993 to determine necessity of facility.

Location and Facility	Year and Purpose	Funds Provided	Description
University of Florida, Alachua Agricultural Biotechnology Institute	1988 Feasibility Study	50,000	Design Complete. Construction underway.
	1989 Planning and Construction	600,000	
	1990 Construction	1,530,000	
	1991 Construction	2,690,000	
	1992 Construction	840,000	
	1993 Construction	276,000	
	Total	5,986,000	
Georgia Southern University, Statesboro Center for Rural Health and Epidemiology	1993 Report	(a)	Preliminary estimates received. Study to be conducted by CSRS in second quarter of FY 1993 to determine necessity of facility.
Savannah State College, Savannah, GA Center for Advanced Water Technology and Energy Systems	1991 Report	(a)	Architectural work underway.
	1992 Planning and Construction	136,000	
	1993 Construction	376,000	
	Total	512,000	
University of Georgia, Athens Biocontainment Facility	1988 Feasibility Study	50,000	Design complete. Construction contract cannot be awarded until all funds are in hand.
	1989 Construction	467,000	
	1990 Construction	985,000	
	1991 Construction	1,992,000	
	1992 Construction	425,000	
	Total	3,919,000	
University of Georgia, Athens Comprehensive Agricultural Livestock and Poultry Facility	1992 Report	(a)	Study conducted by CSRS in FY 1992 and report submitted to Congress.

Location and Facility	Year and Purpose	Funds Provided	Description
University of Georgia, Tifton	1990 Report	(a)	Architectural firm to be hired in
Environmentally Sound Production	1991 Planning and Construction	300,000	second quarter of FY 1993.
Agriculture Laboratory	1992 Construction	1,775,000	
	1993 Construction	1,293,000	
	Total	3,368,000	
University of Georgia, Tifton	1991 Report	(a)	Design work underway.
Vidalia Onion Storage Research Facility	1992 Planning and Construction	225,000	
	1993 Construction	194,000	
	Total	419,000	
University of Hawaii, Manoa	1989 Feasibility Study	50,000	Design completed in third quarter
Center for Tropical and Subtropical	1990 Planning	1,121,000	of FY 1992. Construction
Agriculture	1991 Construction	5,675,000	underway.
	1992 Construction	3,842,000	
	1993 Construction	3,311,000	
	Total	13,999,000	
University of Idaho, Moscow	1990 Report	(a)	Design scheduled for completion
Agricultural Biotechnology Facility	1991 Planning and Construction	590,000	in third quarter of FY 1993.
	1992 Construction	500,000 (b)	
	1993 Construction	431,000	
	Total	1,521,000	
Northwestern University, Evanston, IL	1991 Report	(a)	Phase II of construction
Biotechnology Center	1992 Construction	600,000	scheduled for completion in FY
	1993 Construction	517,000	1994. Facility partially occupied.
	Total	1,117,000	

Location and Facility	Year and Purpose	Funds Provided	Description
University of Illinois, Urbana	1989 Planning	250,000	Design complete. Phase I construction underway.
National Soybean Laboratory	1990 Planning and Construction	1,306,000	
	1991 Construction	1,617,000	
	1992 Construction	1,987,000	
	Total	5,160,000	
Indiana University, Bloomington	1990 Report	(a)	Design completed. Construction will begin in first quarter of FY 1993.
Molecular and Cellular Biotechnology Facility	1991 Planning and Construction	1,500,000	
	1992 Construction	2,750,000	
	1993 Construction	2,155,000	
	Total	6,405,000	
Iowa, Des Moines	1993 Report	(a)	Study to be conducted by CSRS in second quarter of FY 1993 to determine necessity of facility.
Trade Marketing Center			
Kansas State University, Manhattan	1987 Feasibility Study	50,000 (c)	Construction underway.
Plant Science Center	1989 Construction	1,350,000	
	1990 Construction	2,962,000	
	1991 Construction	3,731,000	
	1992 Construction	1,570,000	
	1993 Construction	1,353,000	
	Total	11,016,000	
Northwestern State University, Natchitoches, LA	1993 Report	(a)	Preliminary estimates received. Study to be conducted by CSRS in second quarter of FY 1993 to determine necessity of facility.
Food Processing Facility			

Location and Facility	Year and Purpose	Funds Provided	Description
Northwestern State University, Natchitoches, LA	1993 Report	(a)	Preliminary estimates received. Study to be conducted by CSRS in second quarter of FY 1993 to determine necessity of facility.
Red Meat Processing Facility			
University of Maine, Orono	1993 Report	(a)	Preliminary estimates received. Study to be conducted by CSRS in second quarter of FY 1993 to determine necessity of facility.
Wood Processing Facilities			
University of Maine, Presque Isle	1990 Report	(a)	Design complete.
Building Consolidation	1991 Planning and Construction	150,000	
	1993 Construction	776,000	
	Total	926,000	
University of Maryland, College Park	1991 Report	(a)	Architect to be selected in FY 1993.
Institute fur Natural Products and Environmental Science	1992 Planning and Construction	1,000,000	
	1993 Construction	862,000	
	Total	1,862,000	
Tufts University, Boston, MA	1991 Report	(a)	Under municipal review. Design work to begin in first quarter of FY 1993
Center for Hunger, Poverty, Nutrition, and Policy	1992 Planning and Construction	562,000 (b)	
	1993 Construction	484,000	
	Total	1,046,000	
Michigan State Univ., East Lansing	1989 Planning	1,250,000	Design completed. Construction of final facilities to begin when all funds are in hand.
Food Toxicology Center	1990 Planning and Construction	2,962,000	
	1991 Construction	5,076,000	
	1992 Construction	10,394,000 (b)	
	1993 Construction	4,616,000	
	Total	24,298,000	

Location and Facility	Year and Purpose	Funds Provided	Description
University of Mississippi, Oxford Biological Technology Center for Water and Wetlands Resources	1992 Planning and Constructiion	100,000 (b)	Preliminary planning underway.
	1993 Construction	86,000	
	Total	186,000	
Lincoln University, Jefferson City, MO Bennett Land-Grant Living and Learning Center	1991 Report	(a)	Design work underway. Construction will not begin until all funds are available.
	1992 Planning and Construction	145,000	
University of Missouri, Columbia Biosciences Research Center	1993 Report	(a)	Preliminary estimates received. Study to be conducted by CSRS in second quarter of FY 1993 to determine necessity of facility.
University of Missouri, Columbia Meat Science and Safety Center	1993 Report	(a)	Preliminary estimates received. Study to be conducted by CSRS in second quarter of FY 1993 to determine necessity of facility.
Montana State University, Bozeman Bioscience Research Laboratory	1989 Feasibility Study	50,000	Design work scheduled for completion in the second quarter of FY 1993. Groundbreaking scheduled for third quarter of FY 1993.
	1990 Planning	247,000	
	1991 Construction	1,250,000	
	1992 Construction	1,062,000	
	1993 Construction	915,000	
	Total	3,524,000	
University of Nebraska, Lincoln National Centers for Advanced Technology	1989 Planning	250,000	Design work completed in 1992. Construction underway.
	1990 Planning and Construction	2,962,000	
	1991 Construction	4,500,000	
	1992 Construction	4,500,000	
	Total	12,212,000	

Location and Facility	Year and Purpose	Funds Provided	Description
University of Nevada, Reno	1992 Planning and Construction	250,000	Preliminary planning is underway.
Biochemistry and Biology Field Research Station	1993 Construction	215,000	
	Total	465,000	
Rutgers University, New Brunswick, NJ	1988 Feasibility Study	50,000	Design complete. Construction underway.
Center for Molecular Biology	1989 Planning	250,000	
	1990 Planning	89,000	
	1991 Construction	2,544,000	
	1992 Construction	3,044,000	
	1993 Construction	2,623,000	
	Total	8,600,000	
New Mexico State University, Las Cruces	1993 Report	(a)	Preliminary estimates received. Study to be conducted by CSRS in second quarter of FY 1993 to determine necessity of facility.
Center for Arid Land Studies			
New York Botanical Garden, Bronx	1991 Report	(a)	Preliminary planning is underway. Design work will begin in late 1992.
Library/Herbarium	1992 Planning and Construction	1,350,000	
	1993 Construction	3,697,000	
	Total	5,047,000	
Cornell University, Ithaca	1992 Planning and Construction	375,000	Construction scheduled for completion in second quarter of FY 1993.
Research Greenhouse	1993 Construction	375,000	
	Total	750,000	
North Carolina Biotechnology Center, Research Triangle Park	1990 Report	(a)	Construction completed.
Biotechnology Facility	1991 Planning and Construction	750,000	
	1992 Construction	1,450,000	
	Total	2,200,000	

Location and Facility	Year and Purpose	Funds Provided	Description
Wake Forest Univ., Winston-Salem, NC	1990 Planning and Construction	2,853,000 (d)	Construction Is underway.
Center for Research on Human Nutrition	1992 Construction	1,825,000	
and Chronic Disease Prevention	1993 Construction	3,684,000	
	Total	8,362,000	
Minot State University, Minot, ND	1992 Planning and Construction	240,000 (b)	
Institute for Agricultural and Rural	1993 Construction	1,939,000	
Human Resource Development	Total	2,179,000	
North Dakota State Univ., Fargo	1991 Report	(a)	Project delayed due to Insufficient funding.
Animal Care Facility	1992 Planning and Construction	250,000	
North Dakota State Univ., Fargo	1991 Report	(a)	Construction underway.
Seed Research and Regulatory Facility	1992 Planning and Construction	500,000	
	1993 Construction	431,000	
	Total	931,000	
North Dakota State Univ., Fargo	1992 Report	(a)	CSRS site-visit performed in FY 1992 and study results reported to Congress.
Engineering and Biomechanics Building			
North Dakota State Univ., Fargo	1992 Planning and Construction	375,000 (b)	Preliminary planning underway. Architect will not be appointed until after CSRS site-visit in FY 1993.
Food Processing Pilot Plant	1993 Construction	375,000	
	Total	750,000	
North Dakota State Univ., Fargo	1992 Rescinded by Congress	(e)	
Facilities Completion			

Location and Facility	Year and Purpose	Funds Provided	Description
Univ. of North Dakota, Grand Forks Institute for Agricult[illegible] Health Science and Rural Medicine	1991 Planning and Construction	2,892,000	Construction underway.
	1992 Construction	4,381,000	
	1993 Construction	1,864,000	
	Total	9,137,000	
University of Toledo, Toledo, OH Lake Erie Soil and Water Research and Education Center	1993 Report	(a)	Preliminary estimates received. Study to be conducted by CSRS in second quarter of FY 1993 to determine necessity of facility.
University of Toledo, Toledo, OH Plant Science Research Facility	1992 Planning and Construction	275,000 (b)	Design underway.
	1993 Construction	237,000	
	Total	512,000	
Oklahoma State Univ., Stillwater Beef Cattle Research Facility	1993 Report	(a)	Preliminary estimates received. Study to be conducted by CSRS in second quarter of FY 1993 to determine necessity of facility.
Oklahoma State Univ., Stillwater National Center for Equine and Bovine Biotechnology Research	1988 Feasibility Study	50,000	Construction to begin in second quarter of FY 1993.
	1990 Planning	296,000	
	1992 Construction	225,000	
	Total	571,000	
Oregon State University, Astoria Seafood Center	1991 Report	(a)	Design work underway.
	1992 Planning and Construction	217,000 (b)	
	1993 Construction	1,824,000	
	Total	2,041,000	
Oregon State University, Portland Regional Food Innovation Center	1992 Report	(a)	Design work is scheduled to begin in Fall 1992.

Location and Facility	Year and Purpose	Funds Provided	Description
St. Joseph's University, Philadelphia, PA	1991 Planning	600,000	Design work is underway.
Center for Food Marketing	1992 Construction	2,710,000 (b)	Construction scheduled to begin
	1993 Construction	2,336,000	in mid-1993.
		5,646,000	
University of Rhode Island, Kingston	1990 Report	(a)	Design work nearly complete.
Building Consolidation	1991 Planning and Construction	1,904,000	Groundbreaking scheduled for
	1992 Construction	500,000	first quarter of FY 1993.
	1993 Construction	431,000	
	Total	2,835,000	
South Dakota State University, Brookings	1989 Feasibility Study &	100,000	Construction underway.
Northern Plains Biostress Laboratory	1990 Planning	1,879,000	Scheduled for completion in
	1991 Construction	1,970,000	1993.
	1992 Construction	1,515,000	
	1993 Construction	875,000	
	Construction	6,139,000	
	Total		
Middle Tennessee State University, Murfreesboro	1993 Report	(a)	Preliminary estimates received.
Horticulture Public Service Research and Education Center			Study to be conducted by CSRS in second quarter of FY 1993 to determine necessity of facility.
Tennessee State University, McMinnville	1990 Planning and Construction	247,000	Design work is underway.
Nursery Crop Research Station	1991 Construction	248,000	Construction scheduled to begin
	1992 Construction	426,000	in third quarter of FY 1993.
	1993 Construction	367,000	
	Total	1,288,000	

Location and Facility	Year and Purpose	Funds Provided	Description
University of Tennessee, Knoxville Agricultural, Biological and Environmental Research Complex	1992 Planning and Construction	925,000	Design work underway.
	1993 Construction	797,000	
	Total	1,722,000	
Texas A&M University, College Station Center for Southern Crop Improvement	1993 Report	(a)	Preliminary estimates received. Study to be conducted by CSRS in second quarter of FY 1993 to determine necessity of facility.
Texas A&M University, Houston Institute of Biosciences and Technology	1988 Feasibility Study	50,000	Construction complete.
	1989 Construction	1,250,000	
	1990 Construction	2,962,000	
	1991 Construction	3,747,000 (f)	
	1992 Construction	3,860,000	
	1993 Construction	603,000	
	Total	12,472,000	
Utah State University, Logan Biotechnology Laboratory	1990 Report	(a)	Construction underway. Completion scheduled for 1993.
	1991 Planning and Construction	280,000	
	1992 Construction	764,000	
	1993 Construction	658,000	
	Total	1,702,000	
Virginia Polytechnic Institute and State University, Blacksburg Agricultural Biotechnology Center	1988 Feasibility Study	50,000	Design work underway. Construction to begin in third quarter of FY 1993.
	1989 Planning	100,000	
	1990 Planning	112,000	
	1991 Construction	918,000	
	1992 Construction	1,021,000	
	1993 Construction	880,000	
	Total	3,081,000	

Location and Facility	Year and Purpose	Funds Provided	Description
Washington State University, Pullman	1990 Report	(a)	Design work underway.
Animal Disease Biotechnology Facility	1991 Planning and Construction	1,210,000	Groundbreaking scheduled for
	1992 Construction	2,120,000	fourth quarter of FY 1993.
	1993 Construction	2,258,000	
	Total	5,588,000	
University of Wisconsin, Madison	1989 Feasibility Study	50,000	Contract document phase
Agricultural Biotechnology and Genetics	1990 Planning	592,000	underway. Construction
Building	1991 Construction	2,600,000	scheduled to begin in
	1992 Construction	7,393,000	May 1993.
	1993 Construction	2,161,000	
	Total	12,798,000	
University of Wisconsin—Stephens Point	1992 Report	(a)	Design work underway.
Natural Resources Building	1993 Planning	88,000	
University of Wyoming, Laramie	1991 Report	(a)	Architect appointed in third
Environmental Simulation Facility	1992 Planning and Construction	500,000	quarter of FY 1992.
	1993 Construction	431,000	
	Total	931,000	
Reports (a)	1990	298,000	
	1991	300,000	
	1992	150,000	
	1993	260,000	
	Total	1,008,000	

Footnotes:

(a) Funds are provided to the Cooperative State Research Service for the purpose of reporting to Congress on the need for this facility. Actual funds are not earmarked for award to the institution.

(b) Funds carried over to Fiscal Year 1993.

(c) Fiscal Year 1987 funds carried over to Fiscal Year 1989 and awarded with construction funds appropriated in Fiscal Year 1989.

(d) Funds carried over and awarded in Fiscal Year 1991.

(e) Rescinded by Congress. Funds not awarded.

(f) Includes $950,000 appropriated in Fiscal Year 1989 and earmarked for the University of Texas Southwestern in Dallas. Funds redirected to Texas A&M University in Fiscal Year 1991.

TUESDAY, APRIL 20, 1993.

BIOTECHNOLOGY AND PUBLIC POLICY

WITNESSES

FOOD AND DRUG ADMINISTRATION

DAVID A. KESSLER, M.D., COMMISSIONER
MICHAEL TAYLOR, DEPUTY COMMISSIONER FOR POLICY
JIM MARYANSKI, BIOTECHNOLOGY STRATEGIC MANAGER, CENTER FOR FOOD SAFETY & APPLIED NUTRITION

U.S. DEPARTMENT OF AGRICULTURE

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K.D. MURRELL, DIRECTOR, BELTSVILLE AREA, AGRICULTURAL RESEARCH SERVICE
HARLEY W. MOON, DIRECTOR, NATIONAL ANIMAL DISEASE CENTER, AGRICULTURAL RESEARCH SERVICE
GERALD G. STILL, DIRECTOR, PLANT GENE EXPRESSION CENTER, AGRICULTURAL RESEARCH SERVICE
RANDY C. SHOEMAKER, RESEARCH GENETICIST, AGRICULTURAL RESEARCH SERVICE
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STEPHEN B. DEWHURST, BUDGET OFFICER, U.S. DEPARTMENT OF AGRICULTURE

OPENING REMARKS

Mr. DURBIN. Good morning, and thank you for joining us this morning at this hearing to discuss the question of biotechnology and federal policy related to it. We are fortunate to have with us this morning the Commissioner of the Food and Drug Administration, Dr. David Kessler, nice to see you again; Michael Taylor, Deputy Commissioner for Policy, in the back row; and Jim Maryanski, the Biotechnology Strategic Manager, Center for Food

Safety and Applied Nutrition. We also have with us Dr. Dean Plowman, Administrator of the Agricultural Research Service; Dr. John Patrick Jordan, Administrator of the Cooperative State Research Service; and Mr. Terry Medley, Acting Associate Administrator of APHIS.

Let me start with Dr. Kessler. We have your statements for the record, and you have an opportunity now to highlight or summarize. Proceed.

Statement of the FDA Commissioner

Dr. Kessler. Thank you, Mr. Chairman.

The public is faced with what at times must seem like a bewildering assortment of new technologies. And in this environment, it is absolutely essential for people to understand exactly how government is overseeing these developments, and it is essential for people to have confidence in this process. And that is why I would like to commend you, Mr. Chairman, and the members of this committee, for providing this opportunity to discuss one extremely important new technology—that of food biotechnology.

One thing that the public can be absolutely certain about is that the FDA is at the forefront of this emerging field. We are prepared to ensure that these new products meet the same high safety standards as the foods we eat today. Mr. Chairman, members of this committee, biotechnology will not become a back door by which unsafe food products make their ways on to America's dining table.

Let me step back and explain what we are talking about when we use the term "food biotechnology."

We are all familiar with hybrid corn, nectarines, tangelos. These foods were created by inventive men and women using conventional genetic techniques of breeding and selection. But the new genetic engineering techniques differ from their predecessors in two significant ways.

First, they can be used with greater precision. This allows for more complete characterization and therefore greater predictability about the qualities of the new products. These techniques give scientists the ability to isolate genes and introduce new traits into foods without also introducing many of the undesirable effects that often accompany traditional breeding. This is an important improvement over conventional techniques.

Second, today's techniques give breeders the power to cross boundaries that could not be crossed before. For example, they enable the transfer of traits from bacteria or animals into plants. It is this power, the ability to cross natural boundaries, that many in the public worry about when they hear about food biotechnology.

We at the FDA understand this concern. That is why we disagree with those who say that we need to concern ourselves only with the final product; not the process that created it. While study of the final product ultimately answers whether or not the product is safe, knowing the process used to create it helps determine what questions to ask. That is the way FDA currently regulates food products. Products derived through biotechnology will be treated no differently.

Last May FDA published its policy on these new foods in the Federal Register. This was FDA's response to numerous inquiries from industry, from other government agencies, academia and the public who wanted to know the regulatory status of these new products. The questions being asked were just what you might expect: Will FDA require pre-market approval? If genetically engineered foods are marketed without FDA approval, would FDA take enforcement action against them? What scientific information may be necessary to satisfy FDA that genetically engineered foods are safe and comply with the law? Will special labeling be required?

Our policy was developed by FDA scientists. It is based on sound scientific principles for assessing food safety. These principles are consistent with those developed and agreed upon by numerous prestigious expert groups, including the National Academy of Sciences, the Food and Agricultural Organization, the World Health Organization, and the Organization of Economic Cooperation and Development.

We identified four broad safety issues that should be evaluated: One, whether new substances are safe for consumption; two, whether there are any unintended or unexpected changes in the food such as an unacceptable level of a natural toxin; three, whether changes in important nutrients have occurred; and, four, whether steps have been taken to guard against the presence of unexpected allergens.

Mr. Chairman and members of this committee, to help ensure public understanding of and support for our policy FDA requested public comment. We wanted to be certain that a broad segment of the public, including scientists, the food industry and consumers, had an opportunity to give us their views. We received more than 3300 letters; mostly from consumers. The three most frequently raised issues were: one, labeling; two, pre-market notification; and, three, the potential allergenicity of foods derived from genetically engineered plants. And we are working to respond to each of these issues.

Let me begin with labeling. Many consumers stated that they want to know about the food they eat and they requested that genetically engineered foods bear a special labeling. Labeling, by law, has traditionally served two purposes—to identify significant changes in a food's composition, and to ensure the consumers are not misled. In part, this means that information that is material to the representations about the product or material to consequences that may result from its use must be in the product's labeling.

For example, if a tomato had a peanut gene introduced into it, labeling would obviously be needed to alert consumers to the presence of the potential allergen unless it could be demonstrated scientifically that the peanut allergen was not present.

Similarly, if a copy of a new gene was introduced into a carrot and produced a protein that significantly changes the carrot, the name "carrot" may no longer accurately describe the product, and a new name would be required.

We are aware that the consumers are very interested and concern about the labeling of food. We are also aware that new genetic techniques will likely raise novel labeling issues that the agency

has never considered before. We take these matters, and especially concerns about them, very seriously.

Therefore, we are announcing today that FDA will soon publish in the Federal Register a notice requesting further public input that will help to determine when to require labeling of genetically engineered foods. The information requested in this notice will help the agency identify important issues that may be discussed at a future public meeting.

With regard to pre-market notification, many consumers also questioned whether FDA would possess the information it needs to ensure that these new products are safe. Several recommended that FDA consider requiring pre-market notification for these products.

Let me step back and talk a little about the authorities, the many authorities FDA has in place to regulate both traditional foods and foods from the new biotechnology.

We regulate foods derived from new plant varieties under the Federal Food, Drug and Cosmetic Act. In particular, there are two specific authorities: One, the post-market authority of Section 402 of the Act; and, two, the food additive provisions of Section 409, the pre-market approval section.

Substances inserted into food are either food additives, and require pre-market approval, or they are GRAS, which is an acronym meaning that they are generally recognized as safe, and therefore exempt from pre-market review. GRAS substances must have either a long history of safe use in food, or be recognized by a consensus of qualified experts to be safe based on scientific procedures.

Under our food biotechnology policy a substance that would be a food additive, if added during traditional food manufacturing, would also be treated as a food additive if it were introduced through genetic modification of a food crop. For example, a novel sweetener bioengineered into food would require pre-market approval. Our food additive authority also permits us to require pre-market approval of any intentionally introduced substance that raises a legitimate safety concern.

But most substances added to food by genetic engineering will be well-characterized proteins, fats and carbohydrates that producers will claim are GRAS and thus will not require pre-market approval. For these foods there is no requirement that FDA be notified prior to marketing. It is important to keep in mind, however, that the law places a duty, an affirmative duty on food producers to ensure that the foods they market are safe. Should a problem arise, Section 402 of the Act provides FDA with the authority to remove adulterated food from the marketplace.

Historically, this post-market authority has been FDA's primary legal tool to ensure the safety of whole foods, and the system has, in general, worked well to protect consumers. Nevertheless, we will be looking further at pre-market notification as a way to address the interest many have in ensuring that the government has all the information about foods derived from the use of recombinant DNA techniques in plants.

Finally, because of uncertainty about whether specific newly expressed proteins in genetically engineered foods cause allergic reactions, we are exploring how best to further engage the scientific

community on the question of potential allergenicity of food derived from genetically engineered plants.

In conclusion, Mr. Chairman, I want to emphasize again how important it is for us to be able to explain to the public that we have a process in place that they can have confidence in; a policy that will ensure that food biotechnology products are safe. FDA's 1992 policy statement points out that pre-market clearance is required if, and this is a significant point, we have any uncertainty about the safety of the food.

The policy also makes clear, and FDA fully intends that labeling will be required if the composition of the genetically modified food differs significantly from what is expected for that food, or if the modified food contains potential allergens. We are also providing guidance to industry on how to approach these matters and when to consult the FDA. We are determined to take the approach that allows us to ensure the safety of new food products, but also does not prevent the use of safe biotechnology techniques that can give manufacturers the ability to produce better products and provide consumers better choices. We are confident that our approach will do just that.

Thank you.

[CLERK'S NOTE.—The Commissioner's prepared statement appears on pages 865 through 884.]

Mr. DURBIN. Thank you. I would like to mention that I am going to ask the entire panel to testify. I think it is an integrated testimony and we might have better questions when it is all completed.

Dr. Plowman, I would like to introduce you at this point, from the Agricultural Research Service and thank you and your cohorts for the hospitality extended to me yesterday at Beltsville. I learned a lot and it helped me prepare for today's hearing and I am sure it will help in the markup. Thank you for joining us today, and we have your statement and at this time you have an opportunity to speak.

STATEMENT OF THE ARS ADMINISTRATOR

Mr. PLOWMAN. Thank you, Mr. Chairman. We thank you very much for sharing part of your time yesterday at Beltsville. It is a pleasure to have you come and see some of the work we are doing first-hand.

It is a pleasure to be here, too, this morning to talk about biotechnology and some of the things that we are doing. I would like to indicate as far as the Department is concerned we are not the only players in biotechnology. Several of the agencies in the Department have a role to play and so this morning we would like to talk to you a bit about those roles, what ARS is doing as well as CSRS and some of the regulatory aspects that APHIS is responsible for, so we will cover those as we go along.

I would also like to emphasize, too, that we work very closely with many industry groups in biotechnology to effect prompt effective technology transfer so that these products get out quickly and used as soon as possible. We will probably mention a few of those things as we go along.

I would like to emphasize that biotechnology is not a research program in itself. What we are really talking about is a set of new tools to use to do some of the same things we have been doing but in a slower and more cumbersome way. To emphasize that I have brought several colleagues with me today to talk about some of these tools that we do use and we are going to give you some examples of how we are using these tools to solve problems of agriculture. I have listed here on the chart before you, six of these biotechnology tools and I will tell you that we are using these tools in almost all of the things that we do in one way or the other. So, again, it is not a program, it is just a set of tools that we use to solve problems.

[The chart follows:]

Biotechnology Tools

- Tissue culture
- Monoclonal antibodies
- DNA probes
- Recombinant DNA
- Gene mapping
- Gene transfer

USDA ARS

TISSUE CULTURE TECHNIQUES

Dr. PLOWMAN. I would like to introduce you now to Dr. Freddi Hammerschlag. Freddi is going to talk to you about tissue culture and I am sure she will do her usual good job and tell you how she is using this tool to effect changes. Freddi?

Mr. DURBIN. We may need to have you use a microphone.

Dr. HAMMERSCHLAG. The mission of my research is to develop and utilize tissue culture techniques to introduce disease resistance into fruit trees, predominantly peaches and apples. Why? Why is this important?

Number one, it takes many years to breed using conventional techniques to get an improved fruit tree, anywhere from 15 to 20 years. Tissue culture techniques can reduce this time to about half of this.

Another important thing is that breeding requires variability. Conventional techniques require you to have a lot of variability. Within peaches and the peach cultivars we use for breeding, there is very little variability. Tissue culture techniques can generate useful variability.

How have we used these techniques? What problems have we solved? One of the problems I would like to mention today as an example is bacterial leaf spot of peach, an important disease in the Eastern United States. It can affect from 5 percent to 75 percent of the crop which can amount in dollars and cents to anywhere from half-a-million to close to a million dollars of loss. Nobody wants to eat these.

Well, what have we done about it? This is where tissue culture techniques can come in and I would like to have a little show and tell with you. Here we have pieces of peach tissue, pieces of leaf. And this is a peach tree, by the way—here, I will lift up—that we have developed from tissue culture techniques. If you want to, you can pass this around. And the tissue is put in a tissue culture medium which is developed for peach. And what is it? I mean the mystery of it, it is a gel-like substance into which we put all the nutrients, hormones and vitamins and sugars that the tissue will need to produce cells. We produce cells from this little piece of leaf and in the tissue culture environment the cells undergo many genetic changes. And this is great because we want variability.

From those cells we can get clusters of cells and we can change and put the tissue on a different tissue culture medium and we can get plants. And here we have plants coming from those cell cultures. Each one has the potential of being different. We can separate them out and we can take them and put them on another medium to allow them to grow and then we can test them for resistance to the bacterium that causes bacterial leaf spot and that is what we did. We had a lot of variability and we picked out the plants that showed high levels of resistance.

TISSUE CLONING

We then went to another tissue culture technique—here is a nice peach—called cloning. And this is making many out of one. We have several plants that we showed at high levels of disease resistance, then we could go in and multiply their number so we could

take them and evaluate them. And here we have one—actually this is apple, but it is the same principle. I call this my orchard in a jar. [Laughter.]

Dr. HAMMERSCHLAG. It is. Think of it. There are probably maybe 150 apple trees in there and we have peaches as well. And we root them and then we put the ones that are disease-resistant into soil. Here is a nice little plant and it looks like a peach plant. And from this you get a real plant. And these plants have gone out to North Carolina and we have been evaluating them for years. Several of them have shown very high levels of disease resistance and we hope to make these available to the public fairly soon.

Not only have we developed resistance to bacterial leaf spot, but we have also developed resistance to two other pathogens and pests and we hope to use the technology and direct it toward important problems of apple. Thank you.

Mr. DURBIN. Thank you.

Dr. PLOWMAN. Okay. So the next time you hear about tissue culture, you know all you need to know about it. Let us turn to the next tool, monoclonal antibodies. We have Dr. Darwin Murrell here to talk to us about how we have used this technology.

MONOCLONAL ANTIBODIES

Dr. MURRELL. Well, I am in a very unenviable position of having to follow Freddi, and anybody in ARS knows what that means, she is so effective. In your packet of materials there is a little handout that I am going to be referring to as I talk about monoclonal antibodies. Monoclonal antibodies is one of the earliest biotechnological tools to come along and I am going to cite an example of how we used that tool to solve a problem in food safety.

The specific food safety problem was trichinosis. This is a disease that is caused by a very small parasite that invades the muscles. It is transmitted by meat. I think most people in this country know that we are required or should cook pork or freeze pork before consuming it.

Although we have extremely small or very low levels of trichinosis in the national swine herd, occasionally outbreaks do occur. During the 1980s there were a number of these outbreaks which occurred and ARS was approached by a number of agencies, the Food Safety and Inspection Service, Animal and Plant Health Inspection Service, and a number of State veterinary services organizations about the possibility of developing a serological test for swine trichinosis.

At that point, the only test that we had involved killing the pig to actually look at the muscle tissue to determine if it was infected. That is not good if you are conducting field studies. The farmers do not want to give up all those animals. We needed a test in which we could take a blood sample and determine whether that pig was infected or not because we knew the prevalence would be so low that it had to be a non-invasive type of test.

In developing a serology test, what is important is that you remove from the organism that you are interested in, such as the parasite, a molecule called an antigen that is responsible for engendering or inducing those antibodies in the infected animal or in

people. And the trick with a parasite as complicated as this is to find that molecule. It is like looking for a needle in a haystack.

So we turned to the monoclonal antibody technology to try to get at this problem and I will tell you a little bit about what is so magic about monoclonal antibodies. But I would like to describe first how we actually do it. And it is in the handout available to you.

What we do is, in this case, infect a mouse with the parasite, trichinellae, and you remove from the mouse those cells that produce the immune response, in this case, an antibody. Now, in vitro, meaning in culture, those cells do not do very well. They will live, but they do not prosper and they do not produce much of the antibody in vitro. However, the technology of monoclonal antibody calls for fusing that cell with a tumor cell, a myeloma cell. That gives these immune cells from the mouse the property of being able to survive for long periods of time in culture. In fact, they are termed as being immortalized. And they also under those conditions produce or clone large amounts of antibody that is identical. Normally when infected with a microorganism, a human or an animal produces a whole array of antibodies that do not all have the same specificity for that molecule in that organism that has invaded the host.

We had to have antibodies that were all identical that identified and matched up with the same antigen, that is the molecule from the parasite eliciting the immune response. By screening a lot of these kinds of systems, we were able to identify a number of what we call clones that were producing large amounts of antibody that identified parasite molecules or antigens. Usually when we found those then we were able to go into the parasite extracts and using that antibody pull out those antigens for testing. We did this on a large scale and it turned out that one of them was essentially the magic bullet. We took this to the field and we tested it in a number of states mostly with State veterinary health services organizations. Illinois was one of the primary test sites for us. And we found that it worked extremely well in the field.

We had a patent on the monoclonal antibody and we were able to give a license to a company in California called IDATECH. And IDATECH produced the test, in a commercial form or kit. I am going to pass this test kit around so you can see what it looks like. The test kit is being used for field studies when a trichinosis outbreak occurs in pigs to try to identify the farm that yielded that infected pig so that we can go to that farm, determine the specific cause and source of those infections and try to eradicate it from those farms.

It also has the potential for being used in inspection. The Food Safety and Inspection Service has recently approved this test kit for meat inspection. Because the prevalence of trichonsis is so low, I do not think it is probably going to be used commercially for large scale meat inspection anytime soon. However, there is a potential for using it for export. Countries that import pork from the United States, because they inspect—they demand that we do it or that we freeze the pork, which is a very expensive process. They may allow us to substitute this test in time for that process. So it could help our export market significantly. Thank you.

Mr. DURBIN. Thank you, Dr. Murrell.

DNA PROBES

Dr. PLOWMAN. He used to be a scientist and now he is an administrator.

We are going to move on now to DNA probes and we have Dr. Harley Moon who is the Director of our Animal Disease Center in Ames, Iowa. He is going to talk to you about the application of a DNA probe to solve a problem.

Dr. MOON. Thank you. I am going to be referring to this little sample of Holstein bull semen. It is this little straw of semen that each of you have available to you in your packet and the application of a DNA test in a probe test to improve animal health through that medium.

I am going to start out with the summary of a Holstein pedigree. It traces back to a bull here at the top of the chart. Bulls are identified where the symbol is square. Cows are indicated in round. This bull, an Osborne Dale Ivanhoe, was referred to as the father of the Holstein breed. He was active in the '50s and '60s. His sons and grandsons and great-grandsons through the power of artificial insemination contributed immensely to the development of that breed. Some of them sired as many as 400,000 calves per year through the power of artificial insemination. A beautifully, highly productive desirable animal, his descendants are the envy of the world and the basis of our export market.

One problem, however, is that he was the carrier for a genetic lethal defect which we now recognize as Bovine Leukocyte Adhesion Deficiency, or BLAD. Here we are down at the bottom of the chart, eight generations later now, dealing with sick and dying young pure-bred Holstein, very valuable animals. Their immune system is crippled. The cells in their blood are unable to handle the ordinary bacterial infections in their environment. They do not respond to treatment and they are dying. They are dying in this country and their descendants that we have exported are dying around the world.

The suspicion was through pedigree analysis that it did trace back to this introduction with Osborne Dale Ivanhoe, the father of the breed, back in the '50s and '60s. Ultimately once the genetic defect was recognized, and the specific gene on those cells in the bloodstream that were responsible for that protein was isolated and identified. The normal gene and the mutant or defective gene that had been inherited from Osborne Dale Ivanhoe was identified and then the DNA sequence identified and validated. Once science had moved to that point the issue was how do we eliminate the problem?

A DNA test was the answer and one of its characteristics, of course, is that it hybridizes with complementary sequences or binds. One strand of DNA will bind and only bind with an identical or complementary DNA sequence. That is the basis for the DNA test. We could then synthesize the DNA or just that fragment of the gene that we were interested in where the defect occurred and mix it with cells from living animals. These cells could be either taken from the bloodstream or from a straw of semen such as we

see here. And if the DNA hybridized with the test DNA we know that we have the defective gene. If it does not, we know that it is not.

ADOPTION OF NEW DNA TECHNOLOGY

That test was rapidly adopted by the dairy industry, by the artificial insemination industry and is now currently in routine use. The straw semen that each of you have at your desk has got information on it concerning the stud and the individual bull from which the semen came. Right in the middle of it you will see a little sign there that says, "Pound BF." What that means is that the animal that produced this semen has been DNA tested by this DNA probe test and found to be free from the defect.

The economic value of this technique at this point is that we have eliminated this $5 million a year annual loss that was occurring in the United States in these calves that had two copies of the defective gene. We have also protected through the routine use of this DNA test by screening bulls before we put them into studs or screening the bulls that are already there before we continue to use them. Through this DNA test we protected our $43 million a year annual export market for Holstein semen and embryos. Thank you.

Dr. PLOWMAN. This is a very significant thing. Ten years ago to eliminate a trait like this in the population you would have had to progeny test all of those bulls that are suspect. You would have had to have mated them with many cows, and then waited to see if their offspring had the trait, which would take a long time and be very, very expensive. But now through this technique we can do it with a blood test and eliminate it, essentially eliminate it out of the whole population. So this has been a very good contribution.

We are going to turn now to the next tool. We are going to skip recombinant DNA for now and talk about gene mapping. This Committee has funded, through the NRI, a genome mapping program that is carried out between the Federal and State scientists around the country, and the objective is to locate on chromosomes of major crop and livestock species as many economically important traits as possible, as many genes as possible so that then eventually we would be able to manipulate those genes to make improvements.

Dr. Randy Shoemaker is going to give us one example in soybeans as to what is occurring in the state of that art.

GENOME MAPPING

Dr. SHOEMAKER. Thank you, Dr. Plowman.

Mr. Chairman, members of the Committee, all of the characteristics that we have heard about reside on pieces of molecules called chromosomes, and all of these chromosomes reside inside of every cell in every organism, whether it is plant or animal. The example that we have here is of soybean. Soybean has 40 of these chromosomes inside every cell. Corn has 20 of these chromosomes. Other crops have other numbers.

The program and the reason for genome mapping is that when plant breeders are attempting to manipulate a crop they need to

sort all of those chromosomes in all of the many thousands of genes that reside on them. It is not unusual for a breeder to make hundreds, if not thousands, of crosses and to evaluate tens of thousands of offspring from these crosses in order to have the random chance of observing that one characteristic that needs to be corrected. The objective of genome mapping is to take a lot of the random chance out of these breeding efforts.

All of the chromosomes that we see contain the hereditary material. Along the chromosomes and along the hereditary material there will be very minute variations. That is the variation that makes everything that we see as diverse as it is. In the laboratory we are able to identify these points of variation along the chromosome, and to orient them in sort of a road map that delineates the chromosome.

We begin by creating a skeleton map, and this is added to with more and more information until we have a detailed map of each of these chromosomes, and finally we begin to identify and map the location of agronomically important genes. The example that we see here is a gene for root rot, a disease that affects soybeans, and another gene down here that affects the development of the seed, the ability of the seed to withstand drought as it desiccates and dries out.

Now, the take-home message from genome mapping is that there are essentially two objectives. The first, we are able to identify agronomically important genes and create markers that allow us to walk closer and closer to these, which has implications for the recombinant DNA technology that you will hear about; and, finally, this kind of resolution on chromosomes, in conjunction with agronomically important genes, allows breeders to create better combinations of traits much faster and much more efficiently.

RECOMBINANT DNA

Dr. PLOWMAN. Thank you, Randy.

Randy mentioned recombinant DNA, and we have Dr. Gerald Still who is the Director of our Plant Gene Expression Center in Albany, California. He is going to give us an example of the use of recombinant DNA.

Dr. STILL. Thank you, Dean.

It is a pleasure being here. I want to start with a real world problem that is illustrated on a display chart.

The real world problem at the top of the chart is tomatoes, and the example I am going to use in this experiment is the age-old problem of regulating ripening. You all recognize that about 40 to 60 percent of the agricultural product that is reared in the field never gets to marketplace because it is lost due to waste and spoilage. It gets too ripe.

And since Biblical times man has been trying to isolate a technology to regulate ripening. In the next few minutes I am going to give you the results of experiments where we now have methods for regulating ripening.

Dr. Theologis in our lab looked at the literature, to understand hormone regulation in plants. And it turns out there is a very simple hormone—ethylene—consisting of two carbons and four hy-

drogens that, if you will, is the accelerator for ripening. Think of taking a tomato plant and putting it into ethylene gas to start the ripening process, including the red coloring, the flavor and the odors. You take the tomato out of ethylene and the ripening stops.

Now, historically, the problem was—Mother Nature turns on ethylene. And how does she turn it on? She turns it on with one gene. And Dr. Yang at the University of California at Davis did a beautiful job in isolating the enzymology of a single gene, or a single protein that produces ethylene, ACC synthetase. You need not remember that.

What Dr. Theologis did was simply this.

Mr. DURBIN. Excuse me, Doctor.

Are you catching the testimony?

The COURT REPORTER. Yes, sir.

Dr. STILL. Okay.

Mr. DURBIN. But you said that last term would not be on the final exam?

Dr. STILL. Yes, sir.

[Laughter.]

Dr. STILL. What he simply did was to a tomato fruit he asked a very simple molecular question, and captured the product of one gene, and that one gene, that one piece of DNA is responsible for the production of the accelerator, the enzyme that produces the hormone ethylene.

Now we come to technology. What Dr. Theologis did was take this piece of DNA, this gene that read A to Z, and turned it around so that it read Z to A. That is Antisense. Not a foreign gene; the gene came out of tomato and went back into the tomato. Stably transformed it. In a minute we will describe how we do that.

What is the phenotype? What do you see in the field? Here is a picture of the control, green tomatoes. The numbers are the days after flowering. After fifty-four days, we have a beautiful vine-ripe, delicious, delectable, gourmet tomato the product of natural ripening. However after seventy days, this product is rotten.

In comparison, photographs of the experiment show effects of the Antisense gene that reads Z to A. What happens? The tomato turns yellow. Look at the dates—110, 125, 152 days. These tomatoes never fully ripen. They do not have the hormone. They do not have the accelerator. Enter technology. You simply take this tomato, put it in a vessel and treat it with Mother Nature's natural hormone, ethylene. It is a natural gas. You can make it in the chemistry lab. And it turns on the biology and there is a cascade of genes, and there is Lipopene synthesis and aroma and your gourmet tomato develops. Ten days, ten parts per million.

APPLICATION OF RECOMBINANT TECHNOLOGY

Now, this invention has been patented by the public. It has been licensed by two U.S. companies, and it has created an enormous opportunity for commerce, for American agriculture. Think of it. You take these tomatoes. You pick them in California. You put them into the hold of a ship and send it to Yokohama. Ten days out if you want to produce ethylene the old-fashioned way, you just simply put in a few crates of ripe avocados that produce the hor-

mone ethylene. By the time the shipment gets to Yokohama you have "vine ripe" tomatoes. This is an example of using recombinant DNA technology, taking a natural gene out of tomato, putting that same gene right back in the tomato, and creating a whole new opportunity for American agriculture.

Thank you.

Dr. PLOWMAN. Have you given Dr. Kessler a problem with that?

Dr. STILL. Dr. Kessler has had the privilege of addressing this problem. CalGene Corporation is one of the licensees. And I might add that the "flavr-savr" tomato that Dr. Kessler is looking at, very shortly our genes are likely to be coming through their product line. And it is the Antisense technology that CalGene of California presently has a property license for.

Dr. PLOWMAN. Okay. While Dr. Still is still on his feet, I would like to have him give you an example of gene transfer, the last one of our biotechnology tools that we will discuss today.

Dr. STILL. Okay, Dr. Plowman.

The first example uses a vehicle for transformation, Mother Nature's natural genetic engineer, an agro-bacterium. I want to share with you here the work that was developed at the Plant Gene Expression Center over the last five years, and this is the first stable transformation of our cereals—corn, wheat, rice, barley and oats.

Dr. Hammerschlag started to give you a crash course in tissue culture. You must realize that tissue culture is an integral part of this process, and without that technology the stable transformation could not have occurred. Stable transformation involves the placement of a gene into a cell, such that it is integrated into the DNA and becomes part of the next generation, and thereafter it breeds that new characteristic.

TRANSFORMATION TECHNOLOGY

The model that I want to illustrate here, involves a gene, a protein from a bacteria, Bt, that controls predation by corn earworm and other insect pests. In this case we use tissue from corn, put it into tissue culture to produce a mass of cells called callus. At this point in the illustration we use the suspension culture. New technology does not require that. Essentially remember that there are clumps of cells. Question: How do you get the DNA into the cells? Answer: We use a small genetic shotgun.

At Cornell University they developed a technique where you actually use small spears of tungsten gold, angstrom size. You coat them with the foreign gene. You put in that gene the DNA of preference, and a gene that serves as a reporter or marker gene. For example, a common marker gener is one the gene that comes from a firefly to produce light. This is important when you get to selection.

The DNA is put on the shotgun pellet. It is shot into the callus cells, literally shot into the callus cells, and some of these cells integrate the DNA and take it up and put it in by recombination into their genome. It is a very low frequency event. That is why we have selection. These cells are plated out and placed just like you have before the committee from the previously discussed tissue culture demonstration. In the case of the firefly marker gene, these

cells that produce light are also the ones that carry the DNA of preference. Those are selected, and regenerated into viable intact plants, just as you earlier saw with the peach tree generated from tissue culture.

The difference now is that every cell in these corn plants have been stably transformed with an enzyme that produces the protein—in this model, Bt. Therefore when the corn earworm caterpillar eats the leaves, it is a lethal experience. That is the bad news for the caterpillar. The good news for you and I is that this protein is not lethal to man.

Again, this model illustrates a combination of stable transformation, tissue culture, molecular biology, moving DNA into the cells, selection, regeneration and now a whole new line of plants with a very discrete, well defined piece of protein from a very well defined, discrete, small piece of DNA. Thank you very much.

Dr. PLOWMAN. It is dangerous to give these folks an opportunity to talk about things like that. You never get them to stop. But I hope what we have done is demonstrate the application of some of these biotechnology tools to solve problems. Again, we have solved the problems much faster than traditional methods would let us, and with a lot more precision. And so we are going to see these tools used more and more as we go along solving problems in agriculture.

Now, if I might, Mr. Chairman, I would turn the discussion to Dr. Jordan, who is going to talk about some other aspects that the Department is doing, and followed by Terry Medley from APHIS.

[CLERK'S NOTE.—The prepared statement of the Administrator of the Agricultural Research Service appears on pages 885 through 893 Biographies for ARS staff appear on pages 894 through 898.]

Mr. DURBIN. Dr. Jordan.

STATEMENT OF THE CSRS ADMINISTRATOR

Dr. JORDAN. Thank you, Mr. Chairman.

As this subcommittee is well aware, the Cooperative State Research Service provides the USDA's entree to that enormous resource, the university-based system of America. It involves about four to 5000 people in 59 state and territorial agricultural experiment stations, 28 colleges of veterinary medicine, 28 schools of forestry, and all the home economics and agricultural colleges of the U.S. It counts among its membership top scientists and science leaders in America, many of whom are members of the National Academy of Sciences. Therefore, it provides a superb counterpart to the Federal research and education agencies providing depth and breadth and optional dimensions as needed, because it has access to virtually any discipline in the university system.

INVESTMENTS IN BIOTECHNOLOGY

In Fiscal Year 1992, this subcommittee funded through CSRS and invested approximately $74 million in agricultural and environmental biotechnology in five different areas: improving scientific knowledge; providing new products and processes; increasing science capability; fostering safe research; the area of coordinating activities.

Dr. Plowman has already provided you with presentations on success stories. I would like to make a comment and a footnote to that. The comment is that you have heard a lot of the interplays between the university scientists and the Federal laboratory system. You can have a tremendous total that is greater than the sum of its parts by interacting between the Federal laboratory personnel and the universities.

The footnote simply is to show you an ancient picture. This is ancient now, but those two calves which are cloned came from the same ovum. It is mechanically split and so they are genetically identical. That is a tremendous breakthrough. This is a decade—in fact, a dozen years old. These are pictures of the first such calves produced in the United States of America, but nevertheless they were produced at a university in concert with our Federal laboratory colleagues.

Also it shows the capacity to direct a specific gene to a specific problem, and what you have is a tremendous saving in time and in dollars in advancing the scientific knowledge. The high altitude station that worked on this one in the Rocky Mountain region took over 30 years to build the prospector line of Herefords, in order to allow them to graze at high altitudes. We can accomplish that same feat now in 10 years or less. So that is the only footnote I would like to make to it.

INCREASING SCIENCE CAPABILITY

Increasing the science capability—if I can have that first chart back—is the next item I would like to focus on for a moment. This committee, through CSRS, has funded annually nearly $4 million in fellowships to universities so that they can recruit and train students studying for graduate degrees in food and agricultural sciences. That is the National Needs Graduate Fellowship Program that you are well aware of.

Biotechnology has always been one of the major areas identified in that sequence. In fact, in the time that this program has been in operation, well over 600 students have come through it. Two hundred and five have been in the area of biotechnology. That is 119 pursuing an education in the plant biotechnology arena, and 86 of them focusing on animal applications.

The NRI portion of the funds in that program are allocated to the Agricultural Research Enhancement Awards and the Strengthening Awards. Approximately 25 percent of the Strengthening Awards were given in the area of biotechnology. Enhancement awards provide support for graduate students, post-doctoral fellows, and new investigators.

FOSTERING SAFER RESEARCH

Moving to the next item, namely, the fostering of safe research. We have a program that has been funded through this committee for several years now, the National Biological Impact Assessment Program—NBIAP as we call it—supported through a special research grant. It is built upon the uniqueness of the networking capability of the Department of Agriculture and the Land Grant University partnership, to involve the scientific community and ad-

vance the safe development of the products of agricultural biotechnology. NBIAP activities are designed to facilitate the safe field testing which is focused on genetically modified organisms. NBIAP provides the scientific community with an electronic bulletin board and a database system that allows them to keep up to date on this kind of technology. Over 6,000 users have been given access to biotechnology and bio-safety information in this manner.

Among the things that are there: the gateway to the databases with information on Federal regulatory requirements for field testing; State-level contacts regarding biotechnology regulations; contacts for Institutional Biosafety Committee members; records of field test locations; current literature in biotechnology supplied by the National Agricultural Library; recently awarded biotechnology patents, and similar information.

Perhaps the most exciting of the new developments is that NBIAP has developed and released an artificial intelligence-mediated computer program that assists researchers in designing both safe field experiments and drafting an application for a Federal permit to conduct the field testing.

To expand on the information of the delivery point and the technology transfer associated with the risk assessment that is incorporated in all this, I call on my colleague, Dr. David R. MacKenzie, who is the principal plant geneticist at CSRS.

NATIONAL BIOLOGICAL IMPACT ASSESSMENT PROGRAM

Dr. MacKenzie. Thank you, Dr. Jordan.

I would like to tell you about our program. It was designed originally by meeting with scientists engaged in biotechnology. We asked them the question, what could we as a Federal agency do to better support your activities? Out of that came a mixture of support programs that not only assist the scientists, but provide them with information and help them comply with the requirements of safe field testing with genetically modified plants, animals, and microbes. What I would like to do is very briefly go through the aspects of the program.

The bulletin board has been very well received within the scientific community, and we are very pleased with the reception of that, and we plan to continue that.

The computerized application system has also been very well received. We are working very closely with APHIS and EPA to make sure that the questions that are asked regarding the development of the permit application meet the needs of the regulatory agencies, and we have examples of the software and the computer disks, that we distribute to people. The latest version was recently being sent out to 500 people.

I would like to focus on the risk assessments grants program because this is a new program mandated in the 1990 Food, Agriculture, Conservation and Trade Act, Section 1668. This program sets aside one percent of the Department's biotechnology research outlays for risk assessment research. It is coordinated very closely with research agencies within the Department, in partnership with Agricultural Research Service and in coordination with the Forest Service, who is also conducting biotechnology research.

We work very closely with the regulatory authorities both within our Department and other agencies such as the Environmental Protection Agency, to set the request for proposals in a way that meets the needs of the regulatory agencies.

The information coming from this helps us provide information for sound regulatory decisions based on the best science available, based on the recommendations of peer panels, and the grants are awarded competitively. It is an extremely competitive program, receiving 77 proposals last year. We awarded eight grants for a total of $1.4 million.

The new solicitation came out in the Federal Register announcement last week. Copies are located on the table. We expect to distribute $1.7 million in 1993, which is again one percent of our biotechnology outlays in the Department of Agriculture.

Finally, the information coming from the program will be incorporated into our biological monitoring database, which is a program we are putting together now. It is a collection of the best information we have available and the decisions regarding safe field testing with genetically modified organisms as we deal with the applicants.

In order to make sure that we have gone even further to coordinate with the different agencies, we are co-sponsoring with the Environmental Protection Agency and Environment Canada a meeting in Duluth, Minnesota, on June 14th through the 16th. It will bring together all the applicants who have received grants from EPA, the USDA's risk assessment program, and Environment Canada, to talk about the discoveries they are making in this research, to build a strong scientific basis for the regulation of biotechnology.

Thank you very much.

COORDINATING ACTIVITIES

Dr. JORDAN. Mr. Chairman, a logical question you would have, I think, is how does the Department of Agriculture coordinate all of this? Some of our specific regulations and whatnot go back quite a ways, 1985 and even before. By 1986, it was clear to the Secretary of Agriculture that this was going to be a critical point. As a result of that, he organized the Committee on Biotechnology in Agriculture—CBA as we call it. It involves the administrators of the six major agencies in the Department that are engaged in biotechnology. That would be the Food Safety and Inspection Service, the Animal and Plant Health Inspection Service, the Forest Service, the Economic Research Service, the Agricultural Research Service, and the Cooperative State Research Service, and it is co-chaired by the Assistant Secretary for Science and Education and the Assistant Secretary for Marketing and Inspection Services.

There is a work group that belongs to this CBA, and it is called the Biotech Council. The Biotech Council is a group of senior scientists, senior staff members from all six of the agencies, and they work under the chairmanship of the chief scientist of the National Research Initiative Dr. Arthur Kelman, who is also here. This group meets monthly to develop the recommendations on biotech-

nology policy issues. It is an active, ongoing, constantly meeting group.

It was important, of course, to have such organizations supported adequately with staff. The Secretary of Agriculture in 1986 also organized the Office of Agricultural Biotechnology. He organized it to allow it not only to support this organization, but also to collect information on both USDA and non-USDA agencies supporting agricultural biotechnology research in support of the Federal Coordinating Council for Science, Engineering, and Technology, the FCCSET organization; specifically, the biotechnology research initiative budget cross-cut. This cross-cut data is collected by the staff from the Office of Agricultural Biotechnology. Dr. Alvin Young, the director of that organization, is also here to answer questions.

This initiative was an attempt to analyze Federal investment in biotechnology research across departmental lines. In fiscal year 1992, USDA's biotechnology investment for both Federal laboratories and academic institutions was $210 million. Adding to that the universities own resources of another $163 million in non-Federal funds, and you have a substantial program moving forward in a coordinated fashion.

BIOTECHNOLOGY ADVISORY COMMITTEE

Also, the Office of Agricultural Biotechnology provides staff support for the advisory committee that we have, the Agricultural Biotechnology Research Advisory Committee, ABRAC as we call it. It is patterned after one at the National Institutes of Health. It has 15 members representing expertise in animal, plant, and microbial sciences, an ecology and environmental policy, food science and technology, laws and regulations and, indeed, even philosophy and bioethics. The membership comes from industry, from academia and from the Federal component as well.

It has two purposes. The ABRAC not only provides that expert advice that the Secretary finds so desperately necessary, but it also provides a magnificent mechanism for listening to the public opinions. This group regularly has open sessions and invites public comment on the issues before it.

The USDA has recently developed a consumer information and education plan that will be unveiled within the next month or two. The objective is to provide the general public with accurate, objective information on the science, potential uses, potential benefits to society, possible risks, and regulatory safeguards for agricultural biotechnology.

OAB also produces "Biotechnology Notes", a monthly publication which is used around the world as a kind of basic bit of information in terms of what is going on, what is happening today so to speak.

CONCLUSION

In conclusion, Mr. Chairman, the CSRS joins the other agencies in a very strong commitment to biotechnology research, education and safety. CSRS and university biotechnology activities stretch all the way from very fundamental, very basic research, to the ap-

plied, pre-commercial type applications. We are deeply committed to ensuring that public funds are being used to meet national and regional needs in agriculture and the environment by providing high quality, safe biotechnology research; research that will support American agriculture, lead to a better quality of life for the American people, and strengthen an economically competitive nation, specifically, the United States of America.

Thank you, Mr. Chairman.

[CLERK'S NOTE.—The prepared statement of the Administrator of the Cooperative State Research Service appears on pages 899 through 910. Biographies for CSRS staff appear on pages 911 and 912.]

Mr. DURBIN. Thank you very much, Dr. Jordan.

Mr. Medley, thanks for joining us, and you are going to speak to us about the role of APHIS in this whole area.

STATEMENT OF APHIS ACTING ASSOCIATE ADMINISTRATOR

Mr. MEDLEY. Good morning. Thank you, Mr. Chairman, members of the committee.

I appreciate the opportunity to talk to you today. In following up on my colleague, Dr. Kessler's concerns about food safety, I would like to discuss APHIS' regulatory program for assuring that transgenic crops are safe to grow. In other words, to discuss with you our programs at APHIS for assuring and protecting agriculture.

APHIS MISSION

As you know, APHIS's mission is to safeguard American agriculture by providing leadership in ensuring the health and care of animals and plants, as well as improve agricultural productivity and competitiveness. Our mission also requires protection of the environment since one cannot adequately protect agriculture without considering the environment as a whole.

PROTECTING ANIMAL HEALTH

In the area of animal health, the Virus-Serum-Toxin Act of 1913, as amended, provides APHIS with the authority to regulate all veterinary biologics that are imported into the United States, shipped or delivered for shipment interstate, intrastate, or that are exported.

APHIS issues U.S. Veterinary Biological Product Licenses after satisfactory completion of all requirements to assure purity, safety, potency, and efficacy. When we talk about veterinary biological products, simply put we are talking about products such as vaccines, and diagnostic kits that are used for treatment or prevention of disease in animals. Veterinary biological products produced by recombinant methods are evaluated on a case-by-case basis using the same standards employed for the licensing of conventionally produced biologics.

In this regard, APHIS has developed a three-category system for recombinant-derived products. We have issued 61 licenses for veterinary biological products manufactured from biotechnological process. Fifty-four are from category one products. These are products that are used prophylactically, therapeutically, or as components of diagnostic kits. Seven licenses have been issued for catego-

ry two products which contain live microorganisms that have been modified by the addition or the deletion of one or more genes. I would like to submit for the record a complete listing of all the biotechnology-derived product licenses issued by APHIS.

[The list follows:]

Licensed Biotech Products

Category I-A. Bacterins/Vaccine, Killed Virus

	Product	Code No.	Licensed Company	No.	Issued
1.	Escherichia Coli Bacterin	26R8.44	Solvay Animal Health Inc.	195	12/23/82
2.	Escherichia Coli Bacterin-Toxoid	7850.00	SmithKline Beecham Corp.	189	03/15/83
3.	Escherichia Coli Bacterin	2648.08	Solvay Animal Health Inc.	195	10/5/83
4.	Escherichia Coli Bacterin	7900.R0	SmithKline Beecham Corp.	189	06/29/84
5.	Escherichia Coli Bacterin	26R8.56	SmithKline Beecham Corp.	189	06/29/84
6.	Pseudorabies Vaccine, Killed Virus	1895.R0	SyntroVet Incorporated	314	06/14/90
7.	Feline Leukemia Virus Antigen	A555.R0	Cambridge BioScience Corp.	317	10/25/90
8.	Feline Leukemia Vaccine, Subunit	1555.R0	Coopers Animal Health, Inc.	107	10/25/90
9.	Bovine Rhinotracheitis Vaccine, Killed Virus	1105.R0	SyntroVet Incorporated	314	11/16/92

*Terminated

Category I-B-1. Therapeutic or Prophylactic Use

	Product	Code No.	Licensed Company	No.	Issued
*1.	Escherichia Coli Monoclonal Antibody	3525.00	Molecular Genetics Inc.	284	11/08/83
*2.	Pseudorabies Virus Monoclonal Antibody	3800.00	Molecular Genetics Inc.	284	04/16/87
3.	Escherichia Coli Monoclonal Antibody	3525.00	Schering-Plough Animal Health	165A	10/07/88
4.	Escherichia Coli Monoclonal Antibody	C525.00	Charles River Lab.	344	01/29/90
5.	Canine Lymphoma Monoclonal Antibody	3405.00	Synbiotics Corporation	312	04/12/91

Category I-B-2. Used in Diagnostic Kits

	Product	Code No.	Licensed Company	No.	Issued
*1.	Feline Leukemia Virus Test Kit	5028.00	Pittman-Moore, Inc.	264	08/22/79
*2.	Equine Infectious Anemia Antibody Test Kit	5515.20	Tech-America Diagnostics	272A	06/28/84
*3.	Feline Infectious Peritonitis Antibody Test Kit	5029.00	Tech-America Diagnostics	272A	11/21/84

*Terminated

Category I-B-2. Used in Diagnostic Kits

	Product	Code No.	Licensed Company	No.	Issued
*4.	Escherichia Coli Antigen Test Kit	5032.00	Molecular Genetics, Inc.	284	01/29/85
5.	Feline Leukemia Virus Antibody Test Kit	5028.00	Cambridge BioScience Corp.	317	10/30/85
6.	Pseudorabies Virus Antibody Test Kit	5110.01	IDEXX Laboratories, Inc.	313	01/16/86
7.	Pseudorabies Virus Antibody Test Kit	5110.02	IDEXX Laboratories, Inc.	313	01/16/86
8.	Feline Leukemia Virus Antigen Test Kit	5028.00	IDEXX Laboratories, Inc.	313	06/16/86
9.	Feline Leukemia Virus Antigen Test Kit	5028.01	IDEXX Laboratories, Inc.	313	03/31/87
10.	Avian Leukosis Virus Antibody Test Kit	5007.01	IDEXX Laboratories, Inc.	313	07/06/87
11.	Canine Parvovirus Test Kit	5024.00	Biocor, Inc.	272	11/12/87
12.	Feline Leukemia Virus Antigen Test Kit	5028.00	Biocor, Inc.	272	11/20/87
13.	Feline Leukemia Virus Antigen Test Kit	5028.02	Biocor, Inc.	272	11/20/87

*Terminated

Category I-B-2. Used in Diagnostic Kits

Product	Code No.	Licensed Company	No.	Issued
14. Feline Infectious Peritonitis Antibody Test Kit	5029.00	Biocor, Inc.	272	11/20/87
15. Equine Infectious Anemia Antibody Test Kit, ELISA	5515.00	Biocor, Inc.	272	11/20/87
16. Equine Infectious Anemia Antibody Test Kit	5515.21	Fermenta Animal Health	272	11/20/87
17. Avian Reovirus Antibody Test Kit	5008.00	Kirkegaard & Perry Labs.	350	12/24/87
18. Feline Immunodeficiency Virus Antibody Test Kit	5036.00	IDEXX Laboratories	313	02/26/88
19. Feline Leukemia Virus Antigen-Feline Immunodeficiency Virus Antibody Test Kit	502A.00	IDEXX Laboratories	313	07/08/88
20. Pseudorabies Virus gpX Antibody Test Kit	5111.00	IDEXX Laboratories	313	08/01/88
21. Feline Immunodeficiency Virus Antigen Test Kit	5038.00	IDEXX Laboratories	313	07/25/89
22. Pseudorabies Virus Antibody Test Kit	5220.00	Biocor, Inc.	272	08/18/89

*Terminated

Category I-B-2. Used in Diagnostic Kit (continued)

Product	Code No.	Licensed Company	No.	Issued
*23. Pseudorabies Virus Antibody Test Kit	5110.00	SmithKline Beacham, Corp.	189	10/05/89
24. Pseudorabies Virus gpX Antibody Test Kit	5111.00	Agdia, Inc.	369	11/22/89
25. Feline Leukemia Virus Test Kit	5028.02	IDEXX Laboratories, Inc.	313	01/19/90
26. Pseudorabies Virus gpIII Antibody Test Kit	5112.00	Biocor, Inc.	272	01/18/90
27. Mycobacterium Paratuber-culosis DNA Test Kit	5066.00	IDEXX Laboratories, Inc.	313	09/12/90
28. Canine Heartworm Antigen Test Kit	5018.03	IDEXX Laboratories, Inc.	313	05/19/92
29. Bovine Rhinotracheitis Virus Antibody Test Kit	5A09.00	IDEXX Laboratories, Inc.	313	06/11/92
30. Mycoplasma Gallisepticum DNA Test Kit	5A70.00	IDEXX Laboratories, Inc.	313	07/21/92
31. Mycoplasma Gallisepticum DNA Test Kit, Accessory F Strain Kit	5A75.00	IDEXX Laboratories, Inc.	313	07/21/92

*Terminated

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Category I-B-2. Used in Diagnostic Kit (continued)

	Product	Code No.	Licensed Company	No.	Issued
32.	Feline Infectious Peritonitis Antibody Test Kit	5029.00	IDEXX Laboratories, Inc.	313	09/17/92
33.	Mycobacterium Paratuberculosis Gamma Interferon Test Kit	5B64.00	IDEXX Laboratories, Inc.	313	09/25/92
34.	Feline Immunodeficiency Virus Antibody Test Kit	5036.00	Synbiotics Corporaation	312	10/01/92
35.	Bluetongue Antibody Test Kit, CELISA	5010.20	Veterinary Diaggnotic Technology, Inc.	336	11/03/92
36.	Mycoplasma Synoviae DNA Test Kit	5A76.00	IDEXX Laboratories, Inc.	313	01/07/93
37.	Brucella Abortus Antibody Test Kit	5013.00	Synbiotics Corporation	312	02/08/93
38.	Bovine Leukemia Antibody Test Kit	5505.20	IDEXX Laboratories, Inc.	313	02/08/93
39.	Pseudorabies Virus gpX Antibody Test Kit	5111.01	Agdia, Inc.	369	03/10/93
40.	Mycobacterium Bovis Gamma Interferon Test Kit	5A64.00	IDEXX Laboratories, Inc.	313	04/02/93

*Terminated

Category II. Live Gene Deleted

	Product	Code No.	Licensed Company	No.	Issued
1.	Pseudorabies Virus Vaccine Modified Live Virus	1891.R0	Biocor, Inc.	272	01/6/86
2.	Pseudorabies Virus Vaccine Modified Live Virus	1891.R0	Diamond Scientific	213	12/03/87
3.	Pseudorabies Virus Vaccine Modified Live Virus	1891.R0	SyntroVet Incorporated	314	03/29/88
4.	Pseudorabies Virus Vaccine, Modified Live Virus	1891.R1	Fermenta Animal Health	272	02/21/89
5.	Parvovirus Pseudorabies Vaccine - Leptospira Canicola-Grippotyphosa-Hardjo-Icterohaemorrhagiae-Pomona Bacterin, Modified Live & Killed Virus	4889.R0	SyntroVet Incorporated	314	11/29/89
6.	Pseudorabies Vaccine-Leptospira Canicola-Grippotyphosa-Hardjo-Icterohaemorrhagiae-Pomona Bacterin, Modified Live Virus	4999.R0	SyntroVet Incorporated	314	11/29/89
7.	Pseudorabies Vaccine Modified Live Virus	1891.R2	SyntroVet Incorporated	314	09/24/91

Category III. Live Vectored

Product	Code No.	Licensed Company	No.	Issued

None issued to date.

Mr. MEDLEY. No category three, live-vectored products, have been licensed to date. However, APHIS has authorized field testing during the last three years in Virginia, Pennsylvania and New Jersey of a live vaccinia vectored rabies vaccine for oral immunization of raccoons. Although no category three licenses have been issued to date, there are 10 applications for category three biotechnology product licenses currently under review by the agency.

In the development and licensing of these products, the field testing of these products is done in accordance with the requirements of the National Environmental Policy Act.

PROTECTING PLANT HEALTH

Next I would like to address the area of plants and protecting plant health. Our regulations in Title 7, Code of Federal Regulations, Part 340, for certain genetically engineered plants and microorganisms, were promulgated under the authority of the Plant Quarantine Act and the Federal Plant Pest Act. Under these regulations we issue permits for the introduction, which includes the importation, interstate movement, and release into the environment, of certain genetically engineered plants and microorganisms. We regulate genetically engineered plants and microorganisms which meet our definition of regulated article because of the inclusion of genetic material from known plant pathogen or plant pest sources.

Since our regulations became effective, almost six years ago, we have issued almost 400 permits for controlled field tests, at over 785 sites in at least 38 different States and Puerto Rico. We currently have 125 such permits pending for field testing at about 400 different sites. For each of the environmental release permits issued, we have prepared a thorough environmental assessment. I would like to submit for the record a complete list of the environmental release permits issued to date. I would also note that the United States leads the world in a number of authorized releases of genetically engineered organisms.

[The list of environmental release permits follows:]

ANIMAL AND PLANT HEALTH INSPECTION SERVICE
ENVIRONMENTAL RELEASE PERMITS ISSUED
THROUGH APRIL 20, 1993

Release Permits — Listed by: Non Pending permits,date

Received	Type	Due Date	I/W	Date issue	Institution	Reg article
16-Jun-87	Release	14-Oct-87	Iss	23-Dec-87	Calgene	Tomato
27-Jul-87	Release	24-Nov-87	Iss	21-Dec-87	Calgene	Tomato
14-Aug-87	Release	12-Dec-87	Iss	28-Dec-87	Du Pont	Tomato
17-Aug-87	Release	15-Dec-87	Iss	25-Nov-87	Calgene	Tobacco
17-Aug-87	Release	15-Dec-87	Iss	11-Dec-87	Calgene	Tobacco
25-Nov-87	Release	24-Mar-88	Iss	23-Mar-88	Monsanto	Tomato
25-Nov-87	Release	24-Mar-88	Iss	23-Mar-88	Monsanto	Tomato
27-Nov-87	Release	26-Mar-88	Iss	22-Mar-88	Du Pont	Tomato
21-Dec-87	Release	19-Apr-88	Iss	25-May-88	Crop Geneti	Clavibacter
11-Jan-88	Release	10-May-88	Iss	25-Apr-88	Monsanto	Tomato
27-Jan-88	Release	26-May-88	Iss	06-Jun-88	Iowa State	Tobacco
28-Jan-88	Release	27-May-88	Iss	24-May-88	Agrigenetics	Tomato
29-Jan-88	Release	28-May-88	Iss	23-May-88	Agrigenetics	Tomato
05-Feb-88	Release	04-Jun-88	Iss	27-Apr-88	Sandoz	Tobacco
10-Feb-88	Release	09-Jun-88	Iss	05-May-88	Monsanto	Tomato
10-Feb-88	Release	09-Jun-88	Iss	23-May-88	Monsanto	Tomato
10-Feb-88	Release	09-Jun-88	Iss	23-May-88	Monsanto	Tomato
23-Feb-88	Release	22-Jun-88	Iss	23-Apr-88	Sandoz	Tobacco
31-Mar-88	Release	29-Jul-88	Iss	28-Jul-88	Du Pont	Tobacco
01-Apr-88	Release	30-Jul-88	Iss	22-Jun-88	Du Pont	Tomato
23-Aug-88	Release	21-Dec-88	Iss	14-Dec-88	Calgene	Tomato
09-Nov-88	Release	09-Mar-89	Iss	22-Feb-89	Monsanto	Tomato
28-Nov-88	Release	28-Mar-89	Iss	13-Mar-89	Rohm and	Tobacco
09-Dec-88	Release	08-Apr-89	Iss	06-Apr-89	Calgene	Tomato
16-Dec-88	Release	15-Apr-89	Iss	30-Mar-89	Calgene	Tomato
16-Dec-88	Release	15-Apr-89	Iss	13-Apr-89	Agracetus	Cotton
20-Dec-88	Release	19-Apr-89	Iss	27-Apr-89	Crop Geneti	Clavibacter
30-Jan-89	Release	30-May-89	Iss	28-Apr-89	Monsanto	Tomato
30-Jan-89	Release	30-May-89	Iss	03-May-89	Monsanto	Potato
30-Jan-89	Release	30-May-89	Iss	26-Apr-89	Monsanto	Potato
03-Feb-89	Release	03-Jun-89	Iss	03-May-89	Monsanto	Cotton
03-Feb-89	Release	03-Jun-89	Iss	04-May-89	Monsanto	Soybean
03-Feb-89	Release	03-Jun-89	Iss	08-May-89	Monsanto	Soybean
03-Feb-89	Release	03-Jun-89	Iss	08-May-89	Monsanto	Soybean
07-Feb-89	Release	07-Jun-89	Iss	30-Jun-89	Northrup Ki	Alfalfa
07-Feb-89	Release	07-Jun-89	Iss	06-Jun-89	Northrup Ki	Alfalfa
16-Feb-89	Release	16-Jun-89	Iss	26-Apr-89	Monsanto	Tomato
16-Feb-89	Release	16-Jun-89	Iss	24-May-89	Calgene	Cotton
22-Feb-89	Release	22-Jun-89	Iss	22-Jun-89	Crop Geneti	Clavibacter

ANIMAL AND PLANT HEALTH INSPECTION SERVICE
ENVIRONMENTAL RELEASE PERMITS ISSUED
THROUGH APRIL 20, 1993

Release Permits — Listed by: Non Pending permits,date

Received	Type	Due date	I/W	Date issue	Institution	Reg article
06-Mar-89	Release	04-Jul-89	Iss	19-May-89	U of Kentuc	Tobacco
14-Mar-89	Release	12-Jul-89	Iss	30-Jun-89	Monsanto	Tomato
15-Mar-89	Release	13-Jul-89	Iss	13-Jul-89	Calgene	Tobacco
07-Apr-89	Release	05-Aug-89	Iss	30-Jun-89	Iowa State	Tobacco
19-Apr-89	Release	17-Aug-89	Iss	28-Jul-89	Iowa State	Poplar
26-Apr-89	Release	24-Aug-89	Iss	06-Jul-89	BioTechnica	Tobacco
16-May-89	Release	13-Sep-89	Iss	11-Aug-89	Pioneer	Alfalfa
16-May-89	Release	13-Sep-89	Iss	14-Aug-89	Calgene	Tobacco
30-May-89	Release	27-Sep-89	Iss	11-Oct-89	Monsanto	Cotton
21-Jun-89	Release	19-Oct-89	Iss	14-Aug-89	New York St	Cucumber
11-Jul-89	Release	08-Nov-89	Iss	10-Oct-89	Calgene	Cotton
27-Jul-89	Release	24-Nov-89	Iss	21-Nov-89	Monsanto	Soybean
08-Aug-89	Release	06-Dec-89	Iss	15-Feb-90	U of Californ	Walnut
14-Sep-89	Release	12-Jan-90	Iss	21-Feb-90	ARS	Potato
05-Oct-89	Release	02-Feb-90	Iss	23-Jan-90	Monsanto	Tomato
05-Oct-89	Release	02-Feb-90	Iss	02-Feb-90	Monsanto	Tomato
17-Oct-89	Release	14-Feb-90	Iss	16-Feb-90	Auburn U	Xanthamonas
20-Oct-89	Release	17-Feb-90	Iss	14-Feb-90	Monsanto	Tomato
27-Oct-89	Release	24-Feb-90	Iss	21-Feb-90	Upjohn	Melon, Squash
01-Nov-89	Release	01-Mar-90	Iss	01-Mar-90	Upjohn	Melon, Squash
01-Nov-89	Release	01-Mar-90	Iss	01-Mar-90	Upjohn	Melon, Squash
07-Nov-89	Release	07-Mar-90	Iss	01-Mar-90	Upjohn	Melon, Squash
16-Nov-89	Release	16-Mar-90	Iss	12-Feb-90	Calgene	Tomato
22-Nov-89	Release	22-Mar-90	Iss	21-Mar-90	Ciba-Geigy	Tobacco
05-Dec-89	Release	04-Apr-90	Iss	05-Apr-90	Northrup Ki	Cotton
28-Dec-89	Release	27-Apr-90	Iss	19-Apr-90	Rohm and	Tobacco
16-Jan-90	Release	16-May-90	Iss	09-May-90	Crop Geneti	Clavibacter
16-Jan-90	Release	16-May-90	Iss	11-Apr-90	Calgene	Cotton
19-Jan-90	Release	19-May-90	Iss	19-Mar-90	Calgene	Tomato
23-Jan-90	Release	23-May-90	Iss	15-May-90	Monsanto	Cotton
25-Jan-90	Release	25-May-90	Iss	16-Apr-90	Monsanto	Cotton
25-Jan-90	Release	25-May-90	Iss	10-May-90	Monsanto	Cotton
29-Jan-90	Release	29-May-90	Iss	31-May-90	Louisiana St	Rice
31-Jan-90	Release	31-May-90	Iss	23-May-90	ARS	Potato
01-Feb-90	Release	01-Jun-90	Iss	08-May-90	Monsanto	Potato
01-Feb-90	Release	01-Jun-90	Iss	27-Apr-90	Monsanto	Cotton
01-Feb-90	Release	01-Jun-90	Iss	19-Apr-90	Monsanto	Potato
02-Feb-90	Release	02-Jun-90	Iss	31-May-90	BioTechnica	Corn
07-Feb-90	Release	07-Jun-90	Iss	07-May-90	Monsanto	Tomato

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ENVIRONMENTAL RELEASE PERMITS ISSUED
THROUGH APRIL 20, 1993

Release Permits — Listed by: Non Pending permits,date

Received	Type	Due date	I/W	Date issue	Institution	Reg article
07-Feb-90	Release	07-Jun-90	Iss	15-May-90	Monsanto	Soybean
07-Feb-90	Release	07-Jun-90	Iss	23-May-90	Monsanto	Soybean
07-Feb-90	Release	07-Jun-90	Iss	09-May-90	Monsanto	Soybean
12-Feb-90	Release	12-Jun-90	Iss	19-Apr-90	Upjohn	Tomato
13-Feb-90	Release	13-Jun-90	Iss	11-May-90	Du Pont	Cotton
28-Feb-90	Release	28-Jun-90	Iss	31-May-90	New York St	Cucumber
06-Mar-90	Release	04-Jul-90	Iss	06-Jul-90	Canners Se	Tomato
06-Mar-90	Release	04-Jul-90	Iss	15-May-90	U of Kentuc	Tobacco
07-Mar-90	Release	05-Jul-90	Iss	09-May-90	Calgene	Tomato
12-Mar-90	Release	10-Jul-90	Iss	21-Jun-90	U of Kentuc	Tobacco
29-Mar-90	Release	27-Jul-90	Iss	11-Jul-90	Upjohn	Melon, Squash
29-Mar-90	Release	27-Jul-90	Iss	06-Jul-90	Upjohn	Melon, Squash
29-Mar-90	Release	27-Jul-90	Iss	03-Jul-90	Upjohn	Melon, Squash
18-Apr-90	Release	16-Aug-90	Iss	12-Sep-90	Calgene	Cotton
24-Apr-90	Release	22-Aug-90	Iss	05-Jun-90	Pioneer	Alfalfa
01-May-90	Release	29-Aug-90	Iss	05-Jul-90	Pennsylvani	Rice
15-May-90	Release	12-Sep-90	Iss	04-Sep-90	U of Wiscon	Pseudomonas
15-May-90	Release	12-Sep-90	Iss	15-Aug-90	Amoco	Tobacco
13-Jun-90	Courtesy	11-Oct-90	Iss	17-Jul-90	U of Wiscon	N/A
26-Jun-90	Release	24-Oct-90	Iss	20-Sep-90	Monsanto	Cotton
03-Jul-90	Release	31-Oct-90	Iss	14-Sep-90	Monsanto	Soybean
06-Sep-90	Release	04-Jan-91	Iss	16-Oct-90	Calgene	Tomato
01-Oct-90	Release	29-Jan-91	Iss	15-Nov-90	Upjohn	Soybean
09-Oct-90	Release	06-Feb-91	Iss	07-Jan-91	Monsanto	Potato
24-Oct-90	Release	21-Feb-91	Iss	06-Mar-91	Calgene	Cotton
30-Oct-90	Release	27-Feb-91	Iss	06-Mar-91	Calgene	Cotton
06-Nov-90	Release	06-Mar-91	Iss	20-Mar-91	ARS	Potato
06-Nov-90	Release	06-Mar-91	Iss	28-Dec-90	Calgene	Tomato
07-Nov-90	Release	07-Mar-91	Iss	12-Mar-91	Frito Lay	Potato
28-Nov-90	Release	28-Mar-91	Iss	17-Apr-91	ARS	Potato
28-Nov-90	Release	28-Mar-91	Iss	12-Mar-91	DeKalb	Corn
28-Nov-90	Release	28-Mar-91	Iss	06-Mar-91	DeKalb	Corn
29-Nov-90	Release	29-Mar-91	Iss	02-Apr-91	Crop Geneti	Clavibacter
10-Dec-90	Release	09-Apr-91	Iss	02-Apr-91	DNA Plant T	Tobacco
11-Dec-90	Release	10-Apr-91	Iss	02-May-91	ARS	Potato
11-Dec-90	Release	10-Apr-91	Iss	02-May-91	Washington	Potato
13-Dec-90	Release	12-Apr-91	Iss	12-Apr-91	Monsanto	Cotton
13-Dec-90	Release	12-Apr-91	Iss	09-Apr-91	North Caroli	Tobacco
17-Dec-90	Release	16-Apr-91	Iss	15-Mar-91	ARS	Walnut

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ENVIRONMENTAL RELEASE PERMITS ISSUED
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Release Permits — Listed by: Non Pending permits,date

Received	Type	Due date	I/W	Date issue	Institution	Reg article
17-Dec-90	Release	16-Apr-91	Iss	18-Apr-91	Calgene	Potato
19-Dec-90	Release	18-Apr-91	Iss	18-Apr-91	Ciba-Geigy	Tobacco
26-Dec-90	Release	25-Apr-91	Iss	24-Apr-91	ARS	Potato
31-Dec-90	Release	30-Apr-91	Iss	19-Mar-91	U of Californ	Tomato
31-Dec-90	Release	30-Apr-91	Iss	02-Apr-91	Upjohn	Melon, Squash
31-Dec-90	Release	30-Apr-91	Iss	02-Apr-91	Upjohn	Melon, Squash
07-Jan-91	Release	07-May-91	Iss	02-May-91	Monsanto	Cotton
07-Jan-91	Release	07-May-91	Iss	26-Apr-91	Monsanto	Potato
07-Jan-91	Release	07-May-91	Iss	03-May-91	ARS	Potato
07-Jan-91	Release	07-May-91	Iss	01-May-91	Biosource	TMV
11-Jan-91	Release	11-May-91	Iss	30-May-91	Monsanto	Tomato
11-Jan-91	Release	11-May-91	Iss	14-May-91	Monsanto	Potato
14-Jan-91	Release	14-May-91	Iss	04-Jun-91	Rogers NK	Tomato
14-Jan-91	Release	14-May-91	Iss	04-Jun-91	Rogers NK	Tomato
16-Jan-91	Release	16-May-91	Iss	01-May-91	Du Pont	Tobacco
18-Jan-91	Release	18-May-91	Iss	24-Apr-91	Monsanto	Soybean
18-Jan-91	Release	18-May-91	Iss	02-Apr-91	Monsanto	Cotton
23-Jan-91	Courtesy	23-May-91	Iss	19-Apr-91	Auburn U	Pseudomonas
24-Jan-91	Release	24-May-91	Iss	14-May-91	Monsanto	Potato
24-Jan-91	Release	24-May-91	Iss	31-May-91	ARS	Potato
25-Jan-91	Release	25-May-91	Iss	01-May-91	BioTechnica	Corn
25-Jan-91	Release	25-May-91	Iss	01-May-91	Du Pont	Cotton
25-Jan-91	Release	25-May-91	Iss	10-May-91	Ciba-Geigy	Corn
25-Jan-91	Release	25-May-91	Iss	21-May-91	Rohm and	Tobacco
30-Jan-91	Release	30-May-91	Iss	10-May-91	Monsanto	Corn
30-Jan-91	Release	30-May-91	Iss	17-May-91	Monsanto	Potato
04-Feb-91	Release	04-Jun-91	Iss	10-May-91	Campbell	Tomato
04-Feb-91	Release	04-Jun-91	Iss	19-Apr-91	Calgene	Cotton
08-Feb-91	Release	08-Jun-91	Iss	22-May-91	ARS	Potato
11-Feb-91	Release	11-Jun-91	Iss	31-May-91	Agrigenetics	Rapeseed
11-Feb-91	Release	11-Jun-91	Iss	26-Apr-91	Auburn U	Xanthamonas
12-Feb-91	Release	12-Jun-91	Iss	10-May-91	Louisiana St	Rice
13-Feb-91	Release	13-Jun-91	Iss	02-May-91	Campbell	Tomato
19-Feb-91	Release	19-Jun-91	Iss	22-May-91	Calgene	Tomato
19-Feb-91	Release	19-Jun-91	Iss	05-Jun-91	Monsanto	Potato
20-Feb-91	Release	20-Jun-91	Iss	22-May-91	Monsanto	Soybean
20-Feb-91	Release	20-Jun-91	Iss	30-May-91	Upjohn	Soybean
21-Feb-91	Release	21-Jun-91	Iss	18-Jun-91	Montana St	Potato
21-Feb-91	Release	21-Jun-91	Iss	15-May-91	Pioneer	Corn

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Release Permits — Listed by: Non Pending permits,date

Received	Type	Due date	I/W	Date issue	Institution	Reg article
21-Feb-91	Release	21-Jun-91	Iss	26-Apr-91	Pioneer	Alfalfa
21-Feb-91	Release	21-Jun-91	Iss	24-Apr-91	Pioneer	Alfalfa
22-Feb-91	Release	22-Jun-91	Iss	07-Jun-91	Upjohn	Tomato
08-Mar-91	Release	06-Jul-91	Iss	10-Jun-91	Pioneer	Sunflower
13-Mar-91	Release	11-Jul-91	Iss	13-May-91	Garst	Corn
15-Mar-91	Release	13-Jul-91	Iss	05-Jun-91	Upjohn	Corn
15-Mar-91	Release	13-Jul-91	Iss	07-Jun-91	New York St	Cucumber
18-Mar-91	Release	16-Jul-91	Iss	18-Jun-91	Harris Mora	Melon
19-Mar-91	Release	17-Jul-91	Iss	05-Jun-91	DNA Plant T	Tomato
20-Mar-91	Release	18-Jul-91	Iss	18-Jun-91	DNA Plant T	Tomato
21-Mar-91	Release	19-Jul-91	Iss	07-Jun-91	U of Wiscon	Alfalfa
04-Apr-91	Release	02-Aug-91	Iss	25-Jun-91	Monsanto	Potato
10-Apr-91	Release	08-Aug-91	Iss	28-Jun-91	Ciba-Geigy	Corn
12-Apr-91	Release	10-Aug-91	Iss	03-Jun-91	U of Kentuc	Tobacco
15-Apr-91	Release	13-Aug-91	Iss	27-Jun-91	Pioneer	Corn
16-Apr-91	Release	14-Aug-91	Iss	13-Aug-91	DNA Plant T	Chrysanthemum
17-Apr-91	Release	15-Aug-91	Iss	11-Jul-91	Calgene	Tomato
17-Apr-91	Release	15-Aug-91	Iss	18-Jun-91	Calgene	Cotton
25-Apr-91	Release	23-Aug-91	Iss	20-Jun-91	ARS	Tobacco
03-May-91	Release	31-Aug-91	Iss	08-Jul-91	Amoco	Tobacco
09-May-91	Release	06-Sep-91	Iss	01-Jul-91	Holdens	Corn
24-May-91	Release	21-Sep-91	Iss	16-Sep-91	Monsanto	Cotton
31-May-91	Release	28-Sep-91	Iss	24-Sep-91	Monsanto	Soybean
05-Jun-91	Release	03-Oct-91	Iss	29-Aug-91	U of Florida	Tobacco
17-Jun-91	Release	15-Oct-91	Iss	15-Oct-91	Calgene	Rapeseed
16-Jul-91	Release	13-Nov-91	Iss	24-Sep-91	Pioneer	Corn
16-Jul-91	Release	13-Nov-91	Iss	24-Sep-91	Pioneer	Corn
22-Jul-91	Release	19-Nov-91	Iss	04-Oct-91	Upjohn	Soybean
24-Jul-91	Release	21-Nov-91	Iss	22-Oct-91	Calgene	Rapeseed
24-Jul-91	Release	21-Nov-91	Iss	19-Nov-91	PetoSeed	Tomato
06-Aug-91	Release	04-Dec-91	Iss	04-Oct-91	Upjohn	Corn
06-Aug-91	Release	04-Dec-91	Iss	04-Nov-91	U of Californ	Apple
10-Sep-91	Release	08-Jan-92	Iss	15-Jan-92	U of Hawaii/	Papaya
25-Sep-91	Release	23-Jan-92	Iss	17-Dec-91	Calgene	Tomato
25-Sep-91	Release	23-Jan-92	Iss	30-Dec-91	Ciba-Geigy	Tobacco
21-Oct-91	Release	18-Feb-92	Iss	04-Dec-91	Frito-Lay	Potato
22-Oct-91	Release	19-Feb-92	Iss	04-Feb-92	Holdens	Corn
28-Oct-91	Release	25-Feb-92	Iss	03-Feb-92	Frito-Lay	Potato
29-Oct-91	Release	26-Feb-92	Iss	14-Feb-92	Frito-Lay	Potato

ANIMAL AND PLANT HEALTH INSPECTION SERVICE
ENVIRONMENTAL RELEASE PERMITS ISSUED
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Release Permits				Listed by: Non Pending permits,date		
Received	Type	Due date	I/W	Date issue	Institution	Reg article
29-Oct-91	Release	26-Feb-92	Iss	23-Dec-91	Cargill	Corn
30-Oct-91	Release	27-Feb-92	Iss	03-Mar-92	Frito-Lay	Potato
13-Nov-91	Release	12-Mar-92	Iss	22-Jan-92	DeKalb	Corn
18-Nov-91	Release	17-Mar-92	Iss	04-Feb-92	North Caroli	Tobacco
20-Nov-91	Release	19-Mar-92	Iss	28-Feb-92	Frito-Lay	Potato
20-Nov-91	Release	19-Mar-92	Iss	19-Mar-92	Frito-Lay	Potato
22-Nov-91	Release	21-Mar-92	Iss	07-Feb-92	Monsanto	Tomato
22-Nov-91	Release	21-Mar-92	Iss	19-Mar-92	Frito-Lay	Potato
22-Nov-91	Release	21-Mar-92	Iss	13-Mar-92	Monsanto	Tomato
25-Nov-91	Release	24-Mar-92	Iss	06-Mar-92	Calgene	Cotton
25-Nov-91	Release	24-Mar-92	Iss	06-Mar-92	Calgene	Cotton
25-Nov-91	Release	24-Mar-92	Iss	20-Mar-92	Calgene	Cotton
25-Nov-91	Release	24-Mar-92	Iss	06-Mar-92	Calgene	Cotton
29-Nov-91	Release	28-Mar-92	Iss	14-Jan-92	Calgene	Cotton
29-Nov-91	Release	28-Mar-92	Iss	20-Apr-92	Calgene	Cotton
09-Dec-91	Release	07-Apr-92	Iss	06-Apr-92	Crop Geneti	Clavibacter
09-Dec-91	Release	07-Apr-92	Iss	06-Apr-92	Pioneer	Alfalfa
12-Dec-91	Release	10-Apr-92	Iss	16-Apr-92	Calgene	Rapeseed
12-Dec-91	Release	10-Apr-92	Iss	07-Feb-92	Pioneer	Soybean
13-Dec-91	Release	11-Apr-92	Iss	14-Apr-92	Monsanto	Cotton
13-Dec-91	Release	11-Apr-92	Iss	15-Apr-92	Monsanto	Cotton
13-Dec-91	Release	11-Apr-92	Iss	14-Apr-92	Monsanto	Cotton
16-Dec-91	Release	14-Apr-92	Iss	20-Apr-92	U of Idaho	Potato
18-Dec-91	Release	16-Apr-92	Iss	13-Apr-92	Calgene	Rapeseed
18-Dec-91	Release	16-Apr-92	Iss	15-Apr-92	Pioneer	Alfalfa
18-Dec-91	Release	16-Apr-92	Iss	17-Mar-92	Frito-Lay	Potato
18-Dec-91	Release	16-Apr-92	Iss	27-Apr-92	Frito-Lay	Potato
19-Dec-91	Release	17-Apr-92	Iss	17-Apr-92	DNA Plant T	Tobacco
19-Dec-91	Release	17-Apr-92	Iss	06-Mar-92	U of Californ	Tomato
23-Dec-91	Release	21-Apr-92	Iss	17-Apr-92	Calgene	Cotton
23-Dec-91	Release	21-Apr-92	Iss	15-Apr-92	Calgene	Potato
24-Dec-91	Release	22-Apr-92	Iss	21-Apr-92	Du Pont	Cotton
24-Dec-91	Release	22-Apr-92	Iss	06-Mar-92	Applied Star	Potato
27-Dec-91	Release	25-Apr-92	Iss	20-Apr-92	Monsanto	Potato
30-Dec-91	Release	28-Apr-92	Iss	05-May-92	Dow	Sorbus sp
01-Jan-92	Release	30-Apr-92	Iss	29-Apr-92	Monsanto	Potato
01-Jan-92	Release	30-Apr-92	Iss	29-Apr-92	Monsanto	Potato
01-Jan-92	Release	30-Apr-92	Iss	16-Apr-92	Pioneer	Corn
01-Jan-92	Release	30-Apr-92	Iss	30-Apr-92	Pioneer	Corn

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ENVIRONMENTAL RELEASE PERMITS ISSUED
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Release Permits				Listed by: Non Pending permits,date		
Received	Type	Due date	I/W	Date issue	Institution	Reg article
01-Jan-92	Release	30-Apr-92	Iss	05-May-92	Pioneer	Corn
07-Jan-92	Release	06-May-92	Iss	29-Apr-92	Monsanto	Soybean
07-Jan-92	Release	06-May-92	Iss	06-May-92	Monsanto	Soybean
07-Jan-92	Release	06-May-92	Iss	06-May-92	Monsanto	Soybean
10-Jan-92	Release	09-May-92	Iss	31-Mar-92	Louisiana St	Rice
14-Jan-92	Release	13-May-92	Iss	29-Apr-92	North Caroli	Tobacco
15-Jan-92	Release	14-May-92	Iss	11-May-92	Monsanto	Soybean
15-Jan-92	Release	14-May-92	Iss	30-Apr-92	Monsanto	Soybean
15-Jan-92	Release	14-May-92	Iss	24-Apr-92	Monsanto	Soybean
15-Jan-92	Release	14-May-92	Iss	14-May-92	Monsanto	Soybean
15-Jan-92	Release	14-May-92	Iss	05-May-92	Monsanto	Soybean
16-Jan-92	Release	15-May-92	Iss	14-May-92	ARS	Potato
17-Jan-92	Release	16-May-92	Iss	11-May-92	InterMountai	Rapeseed
17-Jan-92	Release	16-May-92	Iss	14-May-92	Northrup Ki	Corn
17-Jan-92	Release	16-May-92	Iss	14-May-92	Northrup Ki	Corn
17-Jan-92	Release	16-May-92	Iss	15-May-92	Holdens	Corn
21-Jan-92	Release	20-May-92	Iss	22-May-92	ARS	Potato
22-Jan-92	Release	21-May-92	Iss	21-May-92	Pioneer	Soybean
22-Jan-92	Release	21-May-92	Iss	01-Apr-92	Pioneer	Corn
22-Jan-92	Release	21-May-92	Iss	04-May-92	Pioneer	Corn
22-Jan-92	Release	21-May-92	Iss	21-May-92	Calgene	Tomato
27-Jan-92	Release	26-May-92	Iss	09-Apr-92	Upjohn	Melon, Squash
27-Jan-92	Release	26-May-92	Iss	09-Apr-92	Upjohn	Melon, Squash
28-Jan-92	Release	27-May-92	Iss	27-May-92	Purdue U	Tomato
03-Feb-92	Release	02-Jun-92	Iss	27-Apr-92	DeKalb	Corn
03-Feb-92	Release	02-Jun-92	Iss	12-May-92	ARS	Potato
03-Feb-92	Release	02-Jun-92	Iss	14-May-92	Heinz	Tomato
04-Feb-92	Release	03-Jun-92	Iss	07-May-92	Rogers NK	Tomato
04-Feb-92	Release	03-Jun-92	Iss	24-Apr-92	Campbell	Tomato
04-Feb-92	Release	03-Jun-92	Iss	04-May-92	DNA Plant T	Tomato
05-Feb-92	Release	04-Jun-92	Iss	26-May-92	Washington	Potato
06-Feb-92	Release	05-Jun-92	Iss	14-May-92	Monsanto	Tomato
06-Feb-92	Release	05-Jun-92	Iss	03-Jun-92	Monsanto	Soybean
06-Feb-92	Release	05-Jun-92	Iss	19-May-92	Monsanto	Soybean
06-Feb-92	Release	05-Jun-92	Iss	19-May-92	Monsanto	Corn
06-Feb-92	Release	05-Jun-92	Iss	01-May-92	Monsanto	Soybean
06-Feb-92	Release	05-Jun-92	Iss	21-May-92	Monsanto	Soybean
06-Feb-92	Release	05-Jun-92	Iss	18-May-92	Upjohn	Melon, Squash
10-Feb-92	Release	09-Jun-92	Iss	05-May-92	Monsanto	Soybean

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Release Permits . Listed by: Non Pending permits,date

Received	Type	Due date	I/W	Date issue	Institution	Reg article
10-Feb-92	Release	09-Jun-92	Iss	21-May-92	Northrup Kl	Alfalfa
11-Feb-92	Release	10-Jun-92	Iss	27-May-92	Ciba-Geigy	Corn
11-Feb-92	Release	10-Jun-92	Iss	29-Apr-92	Pioneer	Sunflower
12-Feb-92	Release	11-Jun-92	Iss	05-Jun-92	Hoechst-Ro	Corn
12-Feb-92	Release	11-Jun-92	Iss	22-May-92	Upjohn	Soybean
12-Feb-92	Release	11-Jun-92	Iss	21-May-92	Upjohn	Soybean
14-Feb-92	Release	13-Jun-92	Iss	12-May-92	ARS	Potato
14-Feb-92	Release	13-Jun-92	Iss	12-May-92	ARS	Potato
18-Feb-92	Release	17-Jun-92	Iss	21-May-92	Monsanto	Tomato
18-Feb-92	Release	17-Jun-92	Iss	05-Jun-92	InterMountai	Rapeseed
18-Feb-92	Release	17-Jun-92	Iss	15-Apr-92	PetoSeed	Tomato
18-Feb-92	Release	17-Jun-92	Iss	14-May-92	DeKalb	Corn
18-Feb-92	Release	17-Jun-92	Iss	29-Apr-92	Upjohn	Corn
21-Feb-92	Release	20-Jun-92	Iss	20-May-92	U of Arizona	Tobacco
24-Feb-92	Release	23-Jun-92	Iss	20-May-92	Monsanto	Soybean
25-Feb-92	Release	24-Jun-92	Iss	29-May-92	ICI	Corn
02-Mar-92	Release	30-Jun-92	Iss	05-Jun-92	Campbell	Tomato
05-Mar-92	Release	03-Jul-92	Iss	15-May-92	ARS	Potato
06-Mar-92	Release	04-Jul-92	Iss	04-Jun-92	Holdens	Corn
13-Mar-92	Release	11-Jul-92	Iss	30-Jun-92	American C	Tobacco
13-Mar-92	Release	11-Jul-92	Iss	14-May-92	Monsanto	Soybean
13-Mar-92	Release	11-Jul-92	Iss	14-May-92	Monsanto	Soybean
16-Mar-92	Release	14-Jul-92	Iss	01-Jun-92	Monsanto	Tomato
16-Mar-92	Release	14-Jul-92	Iss	18-Jun-92	New York St	Melon, Squash, Tom
17-Mar-92	Release	15-Jul-92	Iss	01-Jun-92	Pioneer	Corn
20-Mar-92	Release	18-Jul-92	Iss	04-May-92	U of Idaho	Potato
20-Mar-92	Release	18-Jul-92	Iss	04-May-92	Harris Mora	Melon
20-Mar-92	Release	18-Jul-92	Iss	22-May-92	Montana St	Potato
20-Mar-92	Release	18-Jul-92	Iss	03-Jun-92	Upjohn	Corn
20-Mar-92	Release	18-Jul-92	Iss	22-May-92	Cargill	Corn
24-Mar-92	Release	22-Jul-92	Iss	05-Jun-92	ARS	Potato
25-Mar-92	Release	23-Jul-92	Iss	12-Jun-92	Agritope	Tomato
30-Mar-92	Release	28-Jul-92	Iss	01-Jun-92	Upjohn	Soybean
30-Mar-92	Release	28-Jul-92	Iss	29-May-92	Monsanto	Potato
30-Mar-92	Release	28-Jul-92	Iss	10-Jun-92	Monsanto	Tomato
06-Apr-92	Release	04-Aug-92	Iss	05-Jun-92	Stine Seeds	Soybean
14-Apr-92	Release	12-Aug-92	Iss	09-Jun-92	Calgene	Cotton
14-Apr-92	Release	12-Aug-92	Iss	18-Jun-92	Holdens	Corn
15-Apr-92	Release	13-Aug-92	Iss	25-Jun-92	Calgene	Cotton

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Release Permits				Listed by: Non Pending permits,date		
Received	Type	Due date	I/W	Date issue	Institution	Reg article
17-Apr-92	Release	15-Aug-92	Iss	09-Jun-92	Monsanto	Soybean
22-Apr-92	Release	20-Aug-92	Iss	09-Jun-92	U of Wiscon	Pseudomonas
06-May-92	Release	03-Sep-92	Iss	01-Sep-92	Ciba-Geigy	Corn
12-May-92	Release	09-Sep-92	Iss	11-Jun-92	Amoco	Tobacco
19-May-92	Release	16-Sep-92	Iss	11-Sep-92	Ciba-Geigy	Corn
04-Jun-92	Release	02-Oct-92	Iss	23-Sep-92	Calgene	Rapeseed
11-Jun-92	Release	09-Oct-92	Iss	08-Jul-92	Calgene	Rapeseed
12-Jun-92	Release	10-Oct-92	Iss	10-Aug-92	DeKalb	Corn
12-Jun-92	Release	10-Oct-92	Iss	30-Jul-92	MSU	Melon
17-Jun-92	Release	15-Oct-92	Iss	29-Sep-92	DeKalb	Corn
17-Jun-92	Release	15-Oct-92	Iss	13-Oct-92	Northrup Ki	Corn
22-Jun-92	Release	20-Oct-92	Iss	21-Jul-92	Pioneer	Soybean
22-Jun-92	Release	20-Oct-92	Iss	03-Nov-92	Pioneer	Corn
23-Jun-92	Release	21-Oct-92	Iss	28-Aug-92	Upjohn	Corn
24-Jun-92	Release	22-Oct-92	Iss	28-Sep-92	Monsanto	Tomato
30-Jun-92	Release	28-Oct-92	Iss	02-Oct-92	Upjohn	Soybean
01-Jul-92	Release	29-Oct-92	Iss	10-Oct-92	Noble Foun	Alfalfa
09-Jul-92	Release	06-Nov-92	Iss	09-Nov-92	ARS	Plum
21-Jul-92	Release	18-Nov-92	Iss	16-Oct-92	Pioneer	Soybean
27-Jul-92	Release	24-Nov-92	Iss	21-Oct-92	Pioneer	Corn
27-Jul-92	Release	24-Nov-92	Iss	02-Nov-92	Monsanto	Corn
27-Jul-92	Release	24-Nov-92	Iss	17-Nov-92	Monsanto	Corn
30-Jul-92	Release	27-Nov-92	Iss	16-Nov-92	Pioneer	Corn
05-Aug-92	Release	03-Dec-92	Iss	31-Aug-92	Auburn U	Xanthamonas
06-Aug-92	Release	04-Dec-92	Iss	31-Aug-92	Calgene	Tomato
17-Aug-92	Release	15-Dec-92	Iss	10-Nov-92	Pioneer	Soybean
19-Aug-92	Release	17-Dec-92	Iss	19-Apr-93	Monsanto	Rapeseed
31-Aug-92	Release	29-Dec-92	Iss	17-Dec-92	Calgene	Rapeseed
31-Aug-92	Release	29-Dec-92	Iss	08-Oct-92	Holdens	Corn
31-Aug-92	Release	29-Dec-92	Iss	21-Oct-92	Holdens	Corn
01-Sep-92	Release	30-Dec-92	Iss	21-Oct-92	AgriPro	Soybean
01-Sep-92	Release	30-Dec-92	Iss	21-Oct-92	Cargill	Corn
11-Sep-92	Release	09-Jan-93	Iss	23-Nov-92	ICI	Corn
15-Sep-92	Release	13-Jan-93	Iss	04-Dec-92	Northrup Ki	Soybean
16-Sep-92	Release	14-Jan-93	Iss	08-Jan-93	Rogers NK	Petunia
16-Sep-92	Release	14-Jan-93	Iss	19-Nov-92	Monsanto	Soybean
17-Sep-92	Release	15-Jan-93	Iss	20-Nov-92	Monsanto	Soybean
17-Sep-92	Release	15-Jan-93	With	29-Sep-92	Monsanto	Corn
18-Sep-92	Release	16-Jan-93	Iss	02-Nov-92	Monsanto	Corn

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Release Permits — Listed by: Non Pending permits,date

Received	Type	Due date	I/W	Date issue	Institution	Reg article
18-Sep-92	Release	16-Jan-93	Iss	23-Nov-92	Monsanto	Potato
21-Sep-92	Release	19-Jan-93	Iss	02-Nov-92	Monsanto	Corn
21-Sep-92	Release	19-Jan-93	Iss	04-Dec-92	Monsanto	Corn
23-Sep-92	Release	21-Jan-93	With	08-Oct-92	Monsanto	Tomato
05-Oct-92	Release	02-Feb-93	Iss	03-Feb-92	Monsanto	Tomato
27-Oct-92	Release	24-Feb-93	Iss	12-Feb-93	DNA Plant T	Tomato
11-Nov-92	Release	11-Mar-93	Iss	07-Dec-92	Upjohn	Soybean
13-Nov-92	Release	13-Mar-93	With	17-Dec-92	Pioneer	Soybean
13-Nov-92	Release	13-Mar-93	With	23-Nov-92	Connecticut	Chestnut
17-Nov-92	Release	17-Mar-93	Iss	09-Feb-93	Pioneer	Alfalfa
20-Nov-92	Release	19-Mar-93	Iss	14-Apr-93	Wash St. Un	Potato
24-Nov-92	Release	23-Mar-93	Iss	08-Apr-93	Crop Geneti	
25-Nov-92	Release	25-Mar-93	Iss	02-Mar-93	North Caroli	Tobacco
25-Nov-92	Release	25-Mar-93	Iss	13-Apr-93	Pioneer	Corn
30-Nov-92	Release	29-Mar-93	Iss	22-Apr-93	Monsanto	Soybean
08-Dec-92	Release	07-Apr-93	Iss	12-Feb-93	Calgene	Tomato
14-Dec-92	Release	13-Apr-93	Iss	02-Mar-93	Frito-Lay	Potato
14-Dec-92	Release	13-Apr-93	Iss	11-Feb-93	Frito-Lay	Potato
14-Dec-92	Release	13-Apr-93	Iss	02-Mar-93	Frito-Lay	Potato
14-Dec-92	Release	13-Apr-93	Iss	09-Feb-93	Frito-Lay	Potato
15-Dec-92	Release	14-Apr-93	Iss	16-Mar-93	Monsanto	Soybean
16-Dec-92	Release	15-Apr-93	Iss	26-Apr-93	Frito-Lay	Potato
17-Dec-92	Release	16-Apr-93	Iss	27-Jan-93	PetoSeed	Tomato
24-Dec-92	Release	23-Apr-93	Iss	26-Mar-93	Monsanto	Soybean
28-Dec-92	Release	27-Apr-93	Iss	10-Feb-93	Calgene	Rapeseed
28-Dec-92	Release	27-Apr-93	Iss	18-Mar-93	Calgene	Cotton
28-Dec-92	Release	27-Apr-93	Iss	08-Apr-93	Calgene	Cotton
28-Dec-92	Release	27-Apr-93	Iss	14-Apr-93	DeKalb	Corn
28-Dec-92	Release	27-Apr-93	Iss	16-Apr-93	Monsanto	Potato
28-Dec-92	Release	27-Apr-93	Iss	20-Apr-93	Calgene	Rapeseed
30-Dec-92	Release	29-Apr-93	Iss	01-Apr-93	DeKalb	Corn
30-Dec-92	Release	29-Apr-93	Iss	26-Apr-93	Cornell Univ	Apple
11-Jan-93	Release	10-May-93	Iss	05-Apr-93	Monsanto	Cotton
11-Jan-93	Release	10-May-93	Iss	05-Apr-93	Monsanto	Soybean
11-Jan-93	Release	10-May-93	Iss	20-Apr-93	Monsanto	Soybean
12-Jan-93	Release	11-May-93	Iss	02-Mar-93	Monsanto	Soybean
12-Jan-93	Release	11-May-93	Iss	26-Mar-9	Monsanto	Soybean
12-Jan-93	Release	11-May-93	Iss	06-Apr-9	Monsanto	Cotton
14-Jan-93	Release	13-May-93	Iss	13-Apr-93	Ciba-Geigy	Corn

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Release Permits				Listed by: Non Pending permits,date		
Received	Type	Due date	I/W	Date issue	Institution	Reg article
14-Jan-93	Release	13-May-93	Iss	26-Apr-93	Northrup Ki	Corn
19-Jan-93	Release	18-May-93	Iss	26-Mar-93	NC State Un	Tobacco
19-Jan-93	Release	18-May-93	Iss	14-Apr-93	Pioneer	Corn
21-Jan-93	Release	20-May-93	Iss	15-Apr-93	Hoechst-Ro	Corn
21-Jan-93	Release	20-May-93	Iss	22-Apr-93	Hoechst-Ro	Corn
22-Jan-93	Release	21-May-93	Iss	22-Apr-93	Pioneer	Corn
26-Jan-93	Release	25-May-93	Iss	25-Mar-93	U of Florida	Tobacco
26-Jan-93	Release	25-May-93	Iss	26-Mar-93	Pioneer	Corn
26-Jan-93	Release	25-May-93	Iss	26-Mar-93	Purdue Univ	Tomato
26-Jan-93	Release	25-May-93	Iss	14-Apr-93	U Wisc-Mad	Pseudomonas
26-Jan-93	Release	25-May-93	Iss	20-Apr-93	Pioneer	Corn
26-Jan-93	Release	25-May-93	Iss	22-Apr-93	Monsanto	Soybean
02-Feb-93	Release	01-Jun-93	Iss	13-Apr-93	PetoSeed	Tomato
03-Feb-93	Release	02-Jun-93	Iss	13-Apr-93	Calgene	Cotton
10-Feb-93	Release	09-Jun-93	Iss	06-Apr-93	Upjohn	Melon, Squash
10-Feb-93	Release	09-Jun-93	Iss	08-Apr-93	Cargill	Corn
10-Feb-93	Release	09-Jun-93	Iss	08-Apr-93	Cargill	Corn
16-Feb-93	Release	15-Jun-93	Iss	13-Apr-93	Upjohn	Soybean
22-Feb-93	Release	21-Jun-93	Iss	01-Apr-93	Harris Mora	Melon
22-Feb-93	Release	21-Jun-93	Iss	08-Apr-93	Du Pont	Cotton
08-Mar-93	Release	07-Jun-93	Iss	13-Apr-93	U. of Idaho	Potato
08-Mar-93	Release	07-Jun-93	Iss	22-Apr-93	Heinz	Tomato
18-Mar-93	Release	17-Jun-93	Iss	05-Apr-93	Pioneer	Corn
18-Mar-93	Release	17-Jun-93	Iss	22-Apr-93	U Cal-Davis	Tomato
26-Mar-93	Release	25-Jun-93	Iss	22-Apr-93	DNA Plant T	Tomato

LEGEND: I/W = Issued/Withdrawn
Iss = Issued
With = Withdrawn

Mr. MEDLEY. We seek the improvement of productivity and competitiveness by being an effective bridge for technology transfer. This can be accomplished in part by a regulatory framework that removes regulatory uncertainty and establishes appropriate regulatory requirements. Under such a framework the billions of dollars spent for biotechnology research in the public and private sectors should ultimately result in new alternatives for agricultural producers and improved products for consumers.

PUBLIC ACCEPTANCE THROUGH PUBLIC PARTICIPATION

To echo the comments of Commissioner Kessler, what is fundamental to this is public acceptance. Public acceptance through public participation is a cornerstone of our regulatory program. Participation is essential to public acceptance of biotechnology. APHIS acts to inform the public of permit applications it has received through the publication of notices of receipt. Subsequently when a permit has been issued, a notice of availability of an environmental assessment is made known. I would like to point out that in the August 1992 Office of Technology Assessment report entitled, "A New Technological Era for American Agriculture," OTA strongly endorsed the APHIS approach of seeking input from State regulatory personnel in preparing a science-based risk assessment.

DIALOGUE WITH STATE COOPERATORS

Of course, consistent with this is maintaining a continued dialogue with our State cooperators.

As a means of maintaining and enhancing communication and cooperation with our State cooperators, APHIS has taken the lead in sponsoring three national conferences on Federal and State regulation of biotechnology. We are continuing to conduct briefings for members of regional plant boards and to deal with the State regulators whom we interact with on a daily basis.

ADJUSTING REGULATORY OVERSIGHT BASED ON EXPERIENCE

Also fundamental to a regulatory framework which assures safety but also provides for technology transfer is necessary adjustment based on experience. When APHIS issued its regulations in 1987, the agency pledged to amend its biotechnology regulations to keep pace with the scientific state of the art. In keeping this pledge, APHIS made amendments to the regulations in 1988 and 1990 to adjust restrictions on interstate movements of plants and microorganisms under conditions that would insure biological and physical containment.

On March 31st of 1993, APHIS published a final rule amending its regulations pertaining to the introduction of certain genetically engineered plants and microorganisms. These amendments supplemented the existing permitting requirement by adding two alternatives for the introduction of certain genetically engineered plants with which APHIS has had considerable experience.

The alternatives are: (1) a provision for notification of the introduction of certain regulated articles in accordance with established eligibility criteria and performance standards; and, (2) a petition provision for the determination of non-regulatory status. In this

regard, in October 1992 the Department issued its first such determination with regard to the Calgene Flavr Savr Tomato, which stated that the Flavr Savr Tomato is as safe to grow as other tomato varieties.

The notification and petition amendments will become effective on April 30, 1993. What they do is formalize the procedure that we used for the Calgene interpretive decision and they formalized the notification process as well. I wish to emphasize that these amendments are based upon five-and-a-half years of agency experience in issuing over 400 permits for the field testing of transgenic plants, and we believe they are a logical evolution of the regulations.

INTERACTION WITH OTHER USDA AGENCIES

Also important in the area of food safety is interaction with other USDA agencies. Dr. Jordan has previously discussed the intra-departmental mechanism for biotechnology policy coordination. I would like to briefly explain the basis for our interaction with two other USDA agencies related to biotechnology regulatory issues.

In 1985 the responsibility for coordinating biotechnology regulatory policy within the Department and acting as a liaison with public and private organizations on all matters and functions relating to agricultural biotechnology regulatory matters was delegated to the Administrator of APHIS. In this regard we have worked very closely with the Technology Transfer and Coordination staff of the Food Safety and Inspection Service in their development of a regulatory policy for transgenic animals.

We have also been working closely with the Biotechnology Risk Assessment Research Grants Program that was discussed by Dr. MacKenzie earlier today, a program that was established under the Farm Bill of 1990. We expect that the research funded through this program will prove very useful to APHIS in making future regulatory decisions.

COOPERATION WITH FDA AND EPA

In addition to intra-departmental coordination we have very effective cooperative working relationships with both the Food and Drug Administration and the Environmental Protection Agency. As early as August of 1987 EPA and APHIS exchanged letters agreeing that our agencies would collaborate in reviewing applications for field tests where jurisdiction is shared. APHIS officials have regularly forwarded to EPA any permit applications for field testing plants with any added traits that could be considered to meet the definition of pesticide in the Federal Insecticide, Fungicide and Rodenticide Act better known as FIFRA.

During the last several years in anticipation of commercialization of the first genetically engineered crops, APHIS and FDA have been meeting on a regular basis to update our respective staffs and exchange information which each agency finds mutually valuable. FDA has sought to rely upon APHIS environmental analysis, and APHIS has looked to FDA to resolve any food safety issues for plants that producers petition to remove from regulation.

INTERNATIONAL ACTIVITIES

Internationally our activities are aimed toward regulatory harmony, that is, assuring that regulatory processes among our trading partners are compatible. To this end, we have pursued three objectives consistency and compatibility of national approaches; coordination of those national approaches; and most importantly, utilization of science-based principles for evaluation of organisms. We have participated in numerous international activities as departmental or agency representatives or as part of the U.S. delegation to international organizations such as the Inter–America Institute for Cooperation in Agriculture, the Organisation for Economic Cooperation and Development and the Office of Internationale Epizooties.

In the Western Hemisphere our activities have included close coordination and information exchanges with Agriculture Canada and Sanidad Vegetal of Mexico to promote international harmonization of regulations. Many countries, including India, Japan, Israel, and several Central and South American countries, have either adopted or are considering adoption of provisions from our final rule to be used in their own regulatory programs. Germany has indicated particular interest in our system and our notification proposal is getting much attention abroad.

CONCLUSION

In closing, Mr. Chairman, I would like to note that in fiscal year 1992 our fiscal year expenditures for biotechnology totaled $4.9 million, which represents approximately 1 percent of the APHIS budget. These dollars assure protection of American agriculture and should allow the development of significant products for the benefit of agricultural producers and consumers.

Mr. Chairman, that concludes my prepared remarks. I would like to add that Dr. David Espeseth, who is the Deputy Director of our Veterinary Biologics program, and Dr. Jim White, Acting Deputy Director for Biotechnology Permits, are here if you have any questions. Thank you very much.

[Clerk's note.—The prepared statement for the Acting Administrator, Animal and Plant Health Inspection Service appears on pages 913 through 920. Biographies for Mr. Medley and other APHIS staff appear on pages 921 through 923.]

Mr. Durbin. Thanks, Mr. Medley. First, let me thank this panel for coming together. I think that we have tried, at least through the Subcommittee, to shed some light on the jurisdiction which we have through the appropriations process on one of the most exciting and challenging new areas of science.

Let me start with Dr. Kessler. I want to make certain that I understood your testimony and I think you diverted from the text when you made reference to a publication in the Federal Register in the next week or two that is going to invite public comment on labeling. Is this a new direction for the Food and Drug Administration?

FOOD LABELING

Dr. Kessler. It is a continuation, Mr. Chairman, of the questions that we raised in our original 1992 policy. In that statement, in the

1992 policy, we stated that labeling would be required in certain instances when there is an allergic substance, a potentially allergic substance, that when introduced would change the composition of the food, then the food would not be what you think it is and, that would require labeling.

We had a first round of public comment. And those 3300 comments that came in really went to the issue of, "Well, even if you don't change the allergenicity profile, even if you don't change the composition, is there in fact a consumer's right to know just the fact that the product is made through biotechnology?" And what we will do in the next week is issue a Federal Register document that asks more specific questions. Questions that will give us more information on the type of products that will likely be produced and the issues that those products would potentially raise for new labeling concerns. So in some ways it is just a continuation of a policy. The issue is where do you draw the line. What do you label? What is genetic engineering? The traditional techniques that we have been using for years are labeled. There are, as you heard this morning, a whole host of new techniques. Where do you draw the line? What should be labeled and what should not? The information we are seeking will help us get a handle on drawing that line.

Mr. DURBIN. So from your testimony the question is still open as to whether or not there will be additional labeling requirements for food that comes through biotechnology or the genetically engineered process.

Dr. KESSLER. That is correct. We are requiring labeling if you change the composition of the substance, if you raise questions about potential allergenicity. That is a settled question. Labeling will be required. But on this broader question of consumer's right to know, that is still an open question.

FOOD LABELS

Mr. DURBIN. You have indicated that the Food, Drug, and Cosmetic Act does not require that all information that may be of interest to consumers be disclosed on the label. In particular, we are talking about the issue of a genetically engineered food may not need to be put on the label. The question is that even though the FDC Act does not require it, can you, through the regulatory process, mandate that this be on the label?

Dr. KESSLER. Any action the Agency takes must be authorized by the statute. For example, the statute states that a food is misbranded if its labeling ". . . fails to reveal facts material in light of . . . representations or material with respect to consequences which may result from the use of the article . . .". Thus, certain information may be required in a food's labeling if FDA concludes that the information is "material" within the meaning of the statue.

Historically, material information has been confined to information about the attributes of the food itself. In the policy statement on foods derived from new plant varieties issued in May 1992, the Agency stated that FDA has not considered the methods used in the development of a new plant variety to be material information within the meaning of the statute, and that it was not aware of

any information showing that foods derived by new methods differ from other foods in any meaningful way or present any safety concern different from that of foods developed by traditional plant breeding. Thus, the Agency concluded that the method of development of a new plant variety was not material information. However, the agency explained that significant changes in the composition of the food or safety issues, such as allergenicity, must be disclosed in labeling.

The Agency has announced that it is requesting data and information on labeling of genetically engineered foods that the agency needs to determine whether its May 1992 policy should be modified. One of the questions about which FDA has requested information is whether "genetic engineering" is, in fact, material information, and therefore would be required in the labeling for such foods.

TRANSFERRING GENES AND FOOD ALLERGIES

Mr. DURBIN. Dr. Kessler, you have talked about the problem related to using recombinant DNA techniques that might transfer genes from peanuts to tomatoes that might cause allergies in some people. Do you have any rules or regulations currently in place to address the issue of allergies?

Dr. KESSLER. The 1992 policy states that developers who transfer genetic material from a food that is commonly allergenic to another food should consult FDA on the design of appropriate tests to demonstrate that the allergenic determinant has not been transferred to the new food. The policy further states that, in the absence of evidence that the allergenic determinant has not been transferred, food products derived from the new plant variety must bear labeling to alert sensitive individuals to the possible presence of the allergen.

FDA has no general regulation that specifically requires allergenicity labeling. However, an example of existing specific regulations for the label declaration of a substance that may cause an allergic reaction when ingested is that for the color additive FD&C Yellow No. 5, also known as tartrazine. The FDA proposal to require this labeling stated that this action "considered necessary because of mounting evidence of allergic-type reactions to FD&C Yellow No. 5." The proposed rule can be found in the *Federal Register* of February 4, 1977 at 42 FR 6835. The final rule stated "With this action, persons sensitive to FD&C Yellow No. 5 will be able to avoid those products that contain this color additive." The final rule was published in the *Federal Register* of June 26, 1979, at 44 FR 37212.

Mr. DURBIN. When do you anticipate concluding some policy related to food allergies from biotechnology combinations.

Dr. KESSLER. FDA plans to engage the scientific community in 1993 to obtain the best available information on food allergy and to use that information to augment its policy with respect to questions concerning potential allergenicity of foods developed through biotechnology. We anticipate that one or more scientific conferences and public meetings to address allergenicity will be needed to reach a final policy. We hope to conclude our work on this issue in 1994. Based on our current knowledge of foods that are likely to

enter the market, we are not aware of any food that would present clear questions with respect to allergenicity before our work on this policy issue would be completed.

COUNCIL ON COMPETITIVENESS

Mr. DURBIN. I am going to raise a question here, Dr. Kessler that is somewhat political but I think very important for this discussion. Last year the policy related to this whole discussion in food safety was announced through the auspices of Vice President Dan Quayle's Council on Competitiveness. That announcement raised questions in the minds of many people as to whether or not this policy was driven by the political philosophy of that council or whether it was grounded in sound scientific research. I would like your comment at this point as to whether or not that policy, as announced last year, was the product of the FDA process and scientific research or the product of some political agenda.

Dr. KESSLER. The policy that was issued last year was the result of FDA's scientists coming together and looking at the science. And, in fact, we published the policy in the Journal of Science, in the June 26, 1992 Journal of Science. And, if I could, Mr. Chairman, I would like to ask that that scientific article be included in the record.

Mr. DURBIN. Okay.

[The information follows:]

POLICY FORUM

The Safety of Foods Developed by Biotechnology

David A. Kessler, Michael R. Taylor, James H. Maryanski, Eric L. Flamm, Linda S. Kahl

By virtue of its broad regulatory jurisdiction over foods, drugs, biologicals, and medical devices, the Food and Drug Administration (FDA) directs its efforts to ensure that safety and other public health issues are properly addressed as the exciting fruits of new biotechnology come to the market. The FDA has already approved human drugs and vaccines, diagnostic devices, and food processing enzymes produced through recombinant DNA techniques and other tools developed by the recent and continuing revolution in the biological sciences.

Recombinant DNA techniques are now being used to develop new plant varieties that will be sources of foods, such as fruits, vegetables, grains, and their by-products. These techniques enable developers to make specific genetic modifications in plants, including modifications that introduce substances into plants that could not be introduced by traditional methods. To ensure the safety of the resulting foods and to foster innovation, the FDA is taking the initiative, before foods from such plants are ready to enter the market, to see that there is an agreed upon scientific basis to evaluate the safety of whole foods and animal feeds derived from new plant varieties. Here, we summarize our regulatory framework and our approach to safety assessment and discuss its scientific basis (1).

Our safety assessment approach addresses new varieties of food crops developed by both traditional and newer methods of genetic modification and provides guidance on how safety issues should be addressed. The approach identifies scientific or regulatory issues where developers may need to consult the FDA. In developing this approach, we have examined many techniques now available to plant breeders and the types of food safety issues that might arise as a result of those techniques (2–7). However, we focus here primarily on issues associated with foods derived from new plant varieties developed by recombinant DNA techniques. Such foods are now approaching the point of commercial introduction.

We consume in our diet a great diversity of chemical substances. In some cases, these substances are macroconstituents of the daily diet, such as potato starch or wheat gluten. Other substances are microconstituents, such as most flavors, enzymes, vitamins, and minerals. The major classes of food constituents include carbohydrates (mostly monosaccharides, disaccharides, oligosaccharides, and polysaccharides, including gums, starches, and celluloses), fats (mostly triglycerides containing fatty acids of varying chain lengths and degrees of saturation), enzymes and other proteins and peptides, minerals, DNA and RNA, essential oils, waxes, vitamins, pigments, and alkaloids (2).

Developers introduce hundreds of new varieties of food plants into commerce every year. Most have improved agronomic characteristics, such as higher yield. Varieties are also being developed with enhanced quality characteristics, such as improved nutritional or processing attributes. To develop new varieties, breeders use all the techniques at their disposal to generate ever more advantageous combinations of genetic traits.

Breeding techniques include hybridizations between plants of the same species, between plants of different species, and between plants of different genera; chemical and physical mutagenesis; interspecies and intergeneric protoplast fusions; somaclonal variation resulting from regeneration of plants from tissue culture; and in vitro gene transfer techniques.

Traditional methods of plant breeding of some major crops have yielded dramatic changes in food composition, including increases in major plant constituents. For example, traditional breeding resulted in the transformation of the kiwifruit from a small berry native to Asia to the recognizable variety in our grocery stores. Hundreds of similar or more subtle improvements in the agronomic, food processing, or other attributes of food crops have been achieved without any significant adverse impact on the safety of foods (2–4).

Recombinant DNA techniques, which are being used to achieve the same types of goals as traditional techniques, offer plant breeders a number of useful properties. First, any single-gene trait (and, potentially, multi-gene traits) whose chromosomal location or molecular identity is known can be transferred to another organism irrespective of mating barriers. Second, this transfer can be accomplished without simultaneously introducing undesirable traits that are chromosomally linked to the desirable trait in the donor organism. Thus, the techniques have great power and precision.

Currently, more than 30 different agricultural crops developed with recombinant DNA techniques are being tested in field trials. With these techniques, food crops are being developed to resist pests and disease, to resist adverse weather conditions, to tolerate chemical herbicides, and to have improved characteristics for food processing and nutritional content (Table 1). The genes conferring these traits usually encode proteins that are responsible for the new trait or that directly or indirectly modify carbohydrates or fats in the plant to bring about the desired characteristics. In addition, genes encoding antisense messenger RNA have been introduced to decrease gene expression and thereby bring about the desired new phenotype.

FDA Approach to Regulation

The United States today has a food supply that is as safe as any in the world. Most foods predate the establishment of national food laws, and the safety of these foods has been accepted on the basis of extensive use and experience over many years or even centuries. Foods derived from new plant varieties are not routinely subjected to scientific tests for safety, although there are exceptions. For example, potatoes are generally tested for the glycoalkaloid solanine. The established practices that plant breeders use in selecting and developing new varieties of plants, such as chemical analyses, taste testing, and visual analyses, rely primarily on observations of quality, wholesomeness, and agronomic characteristics. Historically, these practices have been reliable for ensuring food safety (2–4).

The Federal Food, Drug, and Cosmetic Act (8) gives the FDA authority to ensure the safety of whole foods. This act places a legal duty on those who develop and sell food to assure the safety of the products they offer to consumers and provides the FDA with a range of legal tools to enforce this duty. The FDA can take action to remove a food from commerce if there is even a "reasonable possibility" that a substance added by human intervention might be unsafe [8, section 402(a)(1)]. The FDA also has authority to require formal premar-

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ket review and approval of substances intentionally added to food if there is a question about safety (that is, if the substance is not generally recognized as safe or "GRAS") (8, section 409).

Because of the limited nature of most modifications likely to be introduced, the FDA would waste its resources and would not advance public health if it were routinely to conduct formal premarket reviews of all new plant varieties. We will require such reviews before marketing, however, when the nature of the intended change in the food raises a safety question that the FDA must resolve to protect public health. The FDA also has a responsibility to provide scientific guidance on how the safety of foods from new plant varieties should be evaluated, regardless of whether formal FDA review and approval are required.

Safety Assessment: Scientific Basis

Our safety assessment approach (Fig. 1), like that of others (2–6) addresses important food safety issues that pertain to the host plant, donor organisms, and new substances that have been introduced into the food. The host plant is a benchmark for considering modifications that may affect the safety of food derived from new varieties. Potential new substances considered in this safety assessment are proteins, carbohydrates, and fats and oils because these are the substances that will be introduced or modified in the first plant varieties developed by recombinant DNA techniques.

The host plant. The host is the plant that is genetically modified and is the recipient of any newly introduced traits. In general, it is a species commonly used as a source of food. We expect that developers will consider information consistent with currently accepted scientific practices, such as the potential adverse effects of an altered metabolic pathway in the plant, the inheritance of the introduced genetic material as a single Mendelian trait, and the genetic stability of the new plant variety. In principle, factors that favor stability and facilitate subsequent genetic manipulation include a minimum number of copies of the introduced genetic material and a single site of insertion. How critical these factors are for maintaining stability is unclear because virtually all plants have multi-gene families.

Developers should consider changes in the concentrations or bioavailability of important nutrients for which a food is widely consumed. For example, if a new tomato variety contained no vitamin C, consumers would need to be informed of that fact through appropriate labeling (for example, a change in the common name).

Most plants produce a number of toxicants and antinutritional factors, such as protease inhibitors, hemolytic agents, and neurotoxins, presumably as a means of resisting natural predators. The concentrations of toxicants in most species of domesticated food plants (for example, corn and wheat) are so low as to present no health concern. In others (for example, potato and rapeseed), breeders routinely screen new varieties to ensure that toxicant concentrations are within an acceptable range. In some cases (for example, cassava and kidney bean), proper preparation, such as soaking and cooking, is required to produce food that is safe to eat (2–4).

Additionally, plants, like other organisms, have metabolic pathways that no longer function because of mutations that occurred during evolution. Products or intermediates of some of these pathways may include toxicants. In rare cases, such silent pathways may be activated by the introduction or rearrangement of regulatory elements, or by the inactivation of repressor genes by point mutations, insertional mutations, or chromosomal rearrangements. Similarly, toxicants ordinarily produced at low concentrations in a plant may be produced at higher levels in a new variety as a result of such occurrences.

However, the likelihood of such events occurring in food plants with a long history of safe use is low. The potential of plant breeding to activate or upregulate pathways synthesizing toxicants has been effectively managed by sound agricultural practices, as evidenced by the fact that varieties with unacceptably high levels of toxicants have rarely been marketed (2–4).

Therefore, the toxicants that are of concern in any particular species are those that have been found at unsafe concentrations in some lines or varieties of that species or related species. In many cases, characteristic properties (such as a bitter taste associated with alkaloids) are known to accompany elevated concentrations of specific natural toxicants, and the absence of bitter taste may provide an assurance that these

Table 1. Examples of food crops under development.

Trait	Genetic modification	Examples of food crops with the trait
Herbicide tolerance		
Glyphosate tolerance	5'-enolpyruvylshikimate-3'-phosphate synthase	Tomato, cotton, soybean, corn, rapeseed
Sulfonylurea/chlorsulfuron tolerance	Acetolactate synthase	Tomato, cotton
Glufosinate/bialophos tolerance	Phosphinothricin acetyltransferase	Corn, soybean, tomato, alfalfa, rapeseed
Bromoxynil tolerance	Nitrilase from *Klebsiella ozaenae*	Cotton, potato
2,4-dichlorophenoxy acetic acid tolerance	*Alcaligenes eutrophus*/2,4-D monooxygenase	Potato
Disease/pest resistance		
Resistance to lepidopteran insects	*Bacillus thuringiensis* delta endotoxin	Tomato, cotton, corn, rapeseed, rice, potato, apple, walnut
Resistance to viruses	Various viral coat proteins	Cantaloupe, squash, tomato, corn, potato, alfalfa
Resistance to bacteria	Cecropin	Potato
Resistance to European corn borer	Wheat germ agglutinin	Corn
Resistance to *Rhizoctonia solani*	Chitinase	Potato
Other agronomic properties		
Cold tolerance	Fish "antifreeze protein"	Tomato
Stress tolerance	Stress-alleviating enzymes	Potato
Altered ripening	Polygalacturonase antisense gene	Tomato
Post-harvest properties		
Simple sugar increase	Metabolic enzymes	Potato
Starch increase	Metabolic enzymes	Potato
Altered fatty acid content	Antisense desaturase and thioesterase oil modification genes	Rapeseed
Increased solids or dry matter content	Pectin methylesterase antisense gene; metabolic enzymes	Tomato, potato
Altered amino acid content	Seed storage proteins	Corn, soybean, rice, sunflower

Source: *Federal Register* notices published by the Division of Biotechnology, Biologics, and Environmental Protection, Animal and Plant Health Inspection Service, U.S. Department of Agriculture.

toxicants have not been elevated to unsafe levels; in other cases, analytical or toxicological tests may be necessary.

The donor. The donor (plant, microorganism, or animal) is the source of the new trait. We expect that producers will consider information consistent with currently accepted scientific practices that might relate to the presence of unintended toxicants, such as history and derivation of molecular constructs (for example, passage through microbial hosts), known activities of any introduced regulatory sequences (for example, environmental, developmental, and tissue-specific effects on promoter activity), and the potential for inadvertently introducing undesirable substances (for example, due to the expression of extraneous open reading frames).

Toxicants known to exist in the donor, related species, or progenitor lines may be transferred to the new plant variety, for example, during hybridization of a cultivated variety with a wild, poisonous relative. The possibility that donor-derived toxicants could occur in food derived from a genetically modified plant should be considered.

One of the questions raised most frequently about the use of recombinant DNA techniques to develop improved food crops concerns the safety for consumption of substances (now primarily proteins, carbohydrates, and fats and oils) that will be introduced into foods such as fruits, vegetables, grains, and their by-products. Here we discuss the scientific issues pertaining to these substances in food derived from the new plant variety.

Proteins. Proteins (including antisense modifications that modulate expression of native proteins) make up the largest group of substances being introduced into food through recombinant DNA techniques. Our approach in evaluating uncertainty associated with proteins is first to ask, "Does the protein have a safe history of use in food, or is it substantially similar to such a food component?" The scientific issues pertaining to proteins that are derived from other food sources, or that are substantially similar to proteins that are derived from food sources, are known toxicity, allergenicity, and dietary exposure.

Thousands of proteins have been safely consumed in the human diet. In fact, the eukaryotic cell contains 5000 or more different polypeptides. Genetic polymorphism, the occurrence of more than one allele of a gene, also contributes to the diversity of proteins in the diet. For example, six alleles of beta-galactosidase have been identified in 39 widely used inbred lines of corn (9). Variation may also occur as a result of posttranslational processing (for example, glycosylation or methylation pattern of the host plant).

This variation is also seen in enzymes derived from microorganisms used in food processing. Enzymes that have the same fundamental catalytic activity may differ in DNA sequence, protein structure, and functional properties (*10*). For example, alpha-amylases from different organisms may differ in optimal conditions of use, such as temperature and pH, and substrate affinity.

Generally, enzymes that are substantially similar to enzymes known to be safely consumed (including minor variations in structure or function) would not raise safety concerns (5, 6, *11*). For example, in food crops a gene coding for an enzyme whose catalytic activity confers herbicide resistance may be isolated from a plant or bacterium, subjected to site-directed mutagenesis to enhance its herbicide resistance, and introduced into the desired host plant to substitute for the biochemical activity of the plant enzyme that is sensitive to the herbicide. However, some enzymes produce toxic substances (for example, the enzymes that convert cyanogenic glycosides to cyanide) that would raise safety questions.

As discussed above, a variety of proteins are present in the diet and have a history of safe consumption. In general, proteins that are currently consumed or substantially similar to proteins already in the diet do not pose specific safety concerns. A seed storage protein, for example, may be transferred from one plant species to another to improve nutritional quality. However, a number of groups of proteins present in common food sources are known to be toxic or antinutritional (for example, lectins and protease inhibitors). Because processing (such as soaking or cooking) may reduce or eliminate the toxic effects of these proteins, many foods that contain these toxic substances are poisonous if eaten raw but safe when properly prepared. Sound scientific practices dictate that such toxic proteins not be introduced into food or animal feed components of new plant varieties.

Many foods produce an allergenic response in some individuals. Foods that

(*Continued on page 1832*)

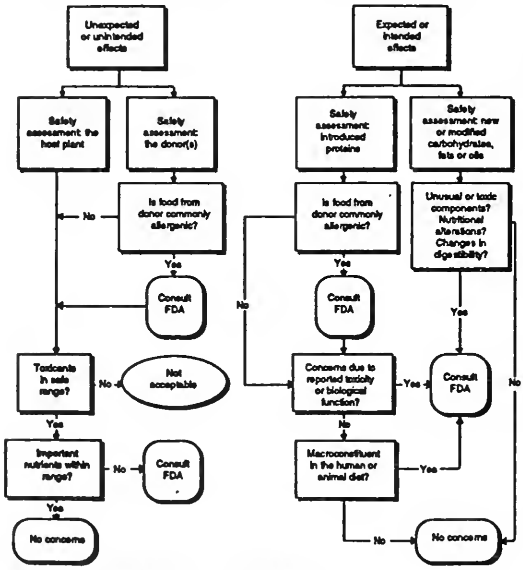

Fig. 1. Summary of safety assessment of new varieties.

(*Continued from page 1749*)

commonly cause allergenic responses include milk, eggs, fish, crustacea, mollusks, tree nuts, wheat, and legumes. Although only a small fraction of the thousands of proteins in the diet have been found to be allergenic, all known food allergens are proteins. The transfer of proteins from one food source to another might therefore confer on food from the host plant the allergenic properties of food from the donor plant. For example, the introduction of a peanut allergen into corn might make that variety of corn newly allergenic to people ordinarily allergic to peanuts.

In some of these foods, the protein responsible for the allergenicity is known (for example, gluten protein in wheat). In such cases, the precision of methods such as recombinant DNA techniques allows the developer to determine whether the allergenic determinant has been transferred from the donor to the new variety. In many foods, however, the protein responsible for the allergenicity is not known. In these cases, well-designed in vitro tests, such as serological tests, may provide evidence that the suspected allergen was not transferred or is not allergenic in the new variety.

A separate issue is whether any new protein in food has the potential to be allergenic to a segment of the population. At this time, we are unaware of any practical method to predict or assess the potential for new proteins to induce allergenicity.

Uncertainty may exist about the safety for consumption of a protein that has not been a constituent of food previously (or has no counterpart in food that would serve as a basis for comparison of safety). The degree of testing these new proteins should be commensurate with any safety concern raised by the objective characteristics of the protein.

Generally, the function of proteins that have been introduced into food by recombinant DNA techniques is well known, and these proteins are not known to exert toxic effects in vertebrates. If such well-characterized proteins do not exhibit unusual functions, safety testing will generally not be necessary.

However, certain groups of proteins are known to be toxic to vertebrates. These include bacterial and animal toxins, hemagglutinins, enzyme inhibitors, vitamin-binding proteins (avidin), vitamin-destroying proteins, enzymes that release toxic compounds, and selenium-containing proteins (*12*). For such substances, testing may be the only means available to ensure safety.

Carbohydrates. Developments that affect carbohydrates will often be modifications of food starches, presumably affecting the content of amylose and amylopectin, as well as the branching of amylopectin. Such modified starches are likely to be functionally and physiologically equivalent to starches commonly found in food and thus would not suggest any specific safety concerns. However, if a vegetable or fruit is modified to produce high concentrations of an indigestible carbohydrate that normally occurs at low concentrations or to convert a normally digestible carbohydrate to an indigestible form, nutritional questions may arise.

Fats and oils. Some alterations in the composition or structure of fats and oils, such as an alteration in the ratio of saturated to unsaturated fatty acids, may have significant nutritional consequences or result in marked changes in digestibility. Such changes may warrant labeling that describes the new composition of the substance. Additionally, safety questions may arise as a result of the presence of fatty acids with chain lengths greater than C_{22}, fatty acids with cyclic substituents, fatty acids with functional groups not normally present in dietary fats and oils, and fatty acids of known toxicity, such as erucic acid.

Nonclinical Safety Testing

Animal feeding trials of foods derived from new plant varieties are not conducted routinely. However, in some cases testing may be needed to ensure safety. For example, substances with unusual functions or that will be new macroconstituents of the diet may raise sufficient concern to warrant testing. Tests could include metabolic, toxicological, or digestibility studies, depending on the circumstances.

Developers may also need to conduct tests on the "wholesomeness" of foods derived from new plant varieties as a means of ensuring that the food does not contain high levels of unexpected, acutely toxic substances. Such tests may provide additional assurance to consumers that food developed by new technology is as safe as food derived from varieties already in their grocery stores. However, animal tests on whole foods, which are complex mixtures, present problems that are not associated with traditional animal toxicology tests designed to assess the safety of single chemicals. Potential toxicants are likely to occur at very low concentrations in the whole food, and the tests may therefore be inadequately sensitive to detect toxicants. Efforts to increase the amount of whole food ingested by the test animals in order to increase the sensitivity and attempt to establish a traditional margin of safety (for example, a 100-fold safety factor) may not always be possible. When tests are contemplated, careful attention should be paid to test protocol, taking into account issues such as nutritional balance and sensitivity.

FDA's science-based approach for ensuring the safety of foods from new plant varieties focuses safety evaluations on the objective characteristics of the food: The safety of any newly introduced substances and any unintended increased concentrations of toxicants beyond the range known to be safe in food or alterations of important nutrients that may occur as a result of genetic modification. Substances that have a safe history of use in food and substances that are substantially similar to such substances generally would not require extensive premarket safety testing. Substances that raise safety concerns would be subjected to closer inquiry. This approach is both scientifically and legally sound and should be adequate to fully protect public health while not inhibiting innovation.

REFERENCES AND NOTES

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3. Nordic Council of Ministers and The Nordic Council, *Food and New Biotechnology* (Scantryk, Copenhagen, 1991)
4. *Approaches to Assessing the Safety of Crops Developed Through Wide-Cross Hybridization Techniques*, proceedings of a Food Directorate Symposium held 22 November 1989, Ottawa, Canada (Food Directorate, Health Protection Branch, Health and Welfare Canada, Ottawa, 1990)
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11. M W Pariza and E M Foster, *J Food Prot* 46, 453 (1983)
12. W G Jaffe, in *Toxicants Occurring Naturally in Foods* (National Academy of Sciences, Washington, DC, 1973), pp 106–128

Dr. KESSLER. In retrospect, I think that everyone would have been a lot better served had we stopped there and allowed the article to be published in the scientific literature. This is a policy that was developed by FDA scientists who work at the agency because they believe in this issue and every ounce of their effort is directed to making sure that we prevent any possibility of harm. The policy got into the hands of the political process and there was a sense, "Well, gee, we are going to deregulate." When this policy was announced with that, "We're going to deregulate the safety of food" interpretation, that set this industry back, years in terms of confidence. This policy is not about deregulating the safety of foods. That is the last thing it is about. We do not even have the first product. You are hearing about things that are in the pipeline. The first product is not yet out there. What we wanted to do at the Agency, rather than lag behind, was to be out there in front and be able to answer questions, to be at the forefront. That is what we intended in issuing the policy. It is not a deregulatory policy. It was an attempt to use the tools that are available, the very powerful tools to enforce, to make sure that the food supply is safe and apply those tools within the statute to this new technology.

Mr. DURBIN. I am glad you made that statement because the impression which you have just relayed has been communicated to me by many people when asked whether or not this was part of some political agenda.

A more specific question is, were you asked to compromise any of your FDA findings or scientific research in this area before this policy was announced by the Council on Competitiveness?

Dr. KESSLER. No. The policy was designed, as published in Science, by FDA scientists and policymakers. There was no compromise. It got spun in a different light, unfortunately, but the policy is what FDA at that time believed was in the public interest. And, again, our thinking is continuing, our thinking is evolving and that is the reason for the notice next week and for the public comment that we are soliciting.

RAPIDLY CHANGING TECHNOLOGY

Mr. DURBIN. It is difficult to believe but we are only 20 years away from the first gene being cloned and, yet, the testimony today is evidence of how quickly this field is developing. Many things are changing almost at breakneck speed. I think the question that we have, and I will ask of the other members of the panel as well, is first, whether our regulatory system at the federal level is sufficient to keep up with these changes and do you have the tools at your disposal to adequately assess the changes as they are taking place? And, second, whether or not there are administrative bottlenecks or conflicting regulation which in any way hampers the agencies involved in this pursuit?

FOOD SAFETY

Dr. KESSLER. Mr. Chairman, the food safety provisions in the Federal Food, Drug and Cosmetic Act, have served this country well now for about 75 years. And those tools to insure the safety of the food supply are enormously flexible. It is those tools that we

are mustering to deal with this new technology; but as we think about the new technology, there may be certain areas in which we need to consider potential new tools. I alluded to one in my testimony. Do we want, and does it make sense to have, pre-market notification before any product is introduced even if it does not trigger a food additive petition? What about the consumer's right to know? The statute right now is written in terms of material facts because of the consequences produced by the substances. But consumers also want information and we take that very seriously. So there may come a time when we come back to you, Mr. Chairman, after we hear the comments from the public, the scientists, and the industry and say that there may need to be some refinement in the tools. But we are not there, yet.

BIOTECHNOLOGY RESOURCES

Mr. DURBIN. For the record please provide a table showing the amount of resources dedicated to biotechnology funding and staff for each of the individual Centers for the past five years.

Dr. KESSLER. I will be happy to provide these estimates for the record.

[The information follows:]

FOOD AND DRUG ADMINISTRATION

BIOTECHNOLOGY RESOURCES
(Dollars in millions)

Center for Food Safety and Nutrition

	FY1989	FY1990	FY1991	FY1992	FY1993
Dollars	$11.9	$15.3	$15.3	$17.6	$18.1
FTE	127	172	169	167	167

Center for Veterinary Medicine

	FY1989	FY1990	FY1991	FY1992	FY1993
Dollars	$0.8	$1.0	$0.9	$1.1	$1.1
FTE	9	11	13	15	15

Center for Devices and Radiological Products

	FY1989	FY1990	FY1991	FY1992	FY1993
Dollars	$1.9	$2.4	$2.9	$4.4	4.5
FTE	22	27	32	51	51

Center for Biologics Evaluation and Research

	FY1989	FY1990	FY1991	FY1992	FY1993
Dollars	$24.4	$31.3	$32.1	$37.0	38.0
FTE	302	340	348	390	390

Center for Drug Evaluation and Research

	FY1989	FY1990	FY1991	FY1992	FY1993
Dollars	$0.7	$0.9	$1.1	$2.2	$2.3
FTE	11	13	16	30	30

National Center for Toxicological Research

	FY1989	FY1990	FY1991	FY1992	FY1993
Dollars	$0.1	$0.1	$0.1	$0.1	$0.1
FTE	1	1	1	1	1

GENETICALLY ENGINEERED FOODS ON THE MARKET

Mr. DURBIN. Since you do not have a mandatory notification procedure or registration process for genetically engineered foods, how is it you will know what kinds of foods are entering the market?

Dr. KESSLER. It is true that firms producing food products are not required to register with FDA or to notify FDA when a new product is introduced into the market. For example, FDA was not notified of the recent introduction of broccoflower, a product of conventional plant breeding. Nevertheless, developers generally consult with the Agency about products developed through new technologies because they want to be confident that FDA will not raise safety or regulatory questions after the product is marketed and because they need to ensure customer and consumer confidence.

Foods developed through genetic engineering that will enter the market within the next 2 to 3 years have been under development for some time. Most of the new plant varieties from which these foods are derived are undergoing field tests under the auspices of USDA/APHIS, which publishes in the Federal Register, a list of all permits issued. FDA has confidence that the Agency knows what kinds of foods have the potential to enter the market in the next 2 to 3 years. In addition, since FDA issued its May 1992 policy, several firms have consulted with the Agency on products that are approaching commercialization, and we expect these consultations to continue.

Mr. DURBIN. Do you believe the Food, Drug, and Cosmetic Act allows you to mandate a notification process?

Dr. KESSLER. The FD&C Act contains no express authority to require a notification process for foods derived from new plant varieties. FDA also does not have authority to require firms who intend to market a food to register with the Agency.

REGULATING BIOTECHNOLOGY

Mr. DURBIN. Dr. Kessler, in your statement you indicate that you intend to use the current regulatory tools available to ensure that new biotechnology products meet the same high safety standards as the foods we eat each day. Obviously, biotechnology issues of the day are ever changing and at breakneck speed. Are you truly convinced that your current regulatory tools are able to keep up with the significant scientific changes that are occurring in biotechnology?

Dr. KESSLER. We developed our policy based on our understanding of current developments in agricultural research and focused on food products in the pipeline that are likely to be commercially successful. We have not attempted to anticipate future technological developments. Rather, we believe that our current policy is sufficiently flexible to permit us to adjust to future developments.

We are confident that our guidance to industry is adequate for products in the pipeline. These foods will be modified to contain proteins, fatty acids, and starches—common food substances whose safety can, in most cases, be assessed by currently available molecular biological and chemical analyses and, if necessary, toxicological tests.

Until recently, most plants developed by recombinant DNA techniques undergoing field tests have been studied for agronomic performance and environmental attributes of the plant. Most firms developing foods through genetic engineering are only now reaching the point in R&D where food safety questions can begin to be addressed, and these firms are consulting with FDA on appropriate safety tests.

We intend to closely monitor developments in this rapidly evolving field, and we will adjust our policy and our guidance to industry, if necessary, to ensure that adequate safety tests will be conducted.

STATES WITH BIOTECHNOLOGY REGULATIONS

Mr. DURBIN. Some states have very active involvement in biotechnology and require strict notification of permitting programs while other states have little or no interest. Would you tell us for the record which states have biotechnology rules and regulations in place and provide a very short description of what each state requires?

Dr. KESSLER. I will be happy to provide this information for the record.

[The information follows:]

States with Biotechnology Rules

Six States have laws or regulations governing bio-engineered organisms:

North Carolina and **Minnesota** have permitting systems for the release into the environment of genetically engineered organisms. North Carolina will review a copy of a permit application to USDA/APHIS. Minnesota requires a State environmental worksheet to be submitted and develops an environmental assessment as part of its permit. There is some question as to whether either of these statutes requires a permit not only for field trials, but also for the sale of genetically engineered foods such as tomatoes with viable seed or yogurt containing viable microbes.

Oklahoma has a permitting system, but only for environmental release of genetically engineered organisms that have not received a Federal permit.

Hawaii requires the simultaneous submission to the State of copies of any Federal application for the release of a genetically engineered organism.

Wisconsin and **Illinois** require notification prior to the environmental release of genetically engineered organisms.

Maine had a one year moratorium on the sale of milk from bST-treated cows. It expired in February, but legislation has been introduced to extend this moratorium an additional year.

New York City is currently considering requiring special labeling for food from genetically engineered organisms.

FEDERAL BIOTECHNOLOGY REGULATIONS

Mr. DURBIN. Where is it that states can go to learn about Federal regulations related to biotechnology? Is there any one-stop place or do they have to visit half-a-dozen different Federal agencies?

Dr. KESSLER. There is no one-stop shopping regarding Federal regulations for biotechnology-derived products, just as there is no one-stop shopping regarding products made by chemical synthesis or fermentation. Rather, States must contact the agency or agencies that have the jurisdiction to regulate the particular product in question. Where some agencies may have overlapping jurisdiction, the relevant Federal agency staff are familiar with each other's rules and regulations, and know who at the other agencies are appropriate people to contact.

For information about regulations governing field releases of genetically engineered organisms, one should contact the Division of Biotechnology, Biologics, and Environmental Protection at USDA/APHIS.

For information about regulations concerning genetically engineered organisms with pesticidal properties, one should contact the Office of Prevention, Pesticides and Toxic Substances at EPA.

For information about regulations concerning genetically engineered foods, one should contact the Biotechnology Strategic Manager of the Center for Food Safety and Applied Nutrition at the Food and Drug Administration.

MEDIATING BIOTECHNOLOGY DISPUTES

Mr. DURBIN. Because of concern within the biotechnology industry, it enlisted, back in the early part of the year, the help of a group called Resolve to help determine whether it could mediate disputes between the biotechnology industry, consumers, and advocacy groups. We know that FDA was contacted and supposedly agreed to initial meetings with Resolve. What is the status of this group?

Dr. KESSLER. FDA welcomes and encourages substantive dialogue on issues that relate to its policy on food biotechnology. FDA officials met with representatives of Resolve in January, 1993, at Resolve's request, to discuss issues related to food biotechnology and to explore possible ways to address the diverse concerns that have been raised. The representatives of Resolve informed FDA that they were conducting a feasibility study at the request of an industry association to identify issues of concern and to explore mechanisms to address the issues. Recently, we received a letter dated April 2, 1993, from Resolve which relates the findings of the feasibility study that the firm conducted. FDA is reviewing that feasibility study, but the agency has not commented on the study or made a decision with respect to this matter.

SAFETY OF TRANSGENIC FOODS

Mr. DURBIN. The International Food Biotechnology Council has indicated, in their opinion, that the standard toxicological testing is not the most appropriate means of assessing safety of transgenic whole foods and that there are other methods of testing that would

be more appropriate. Can you describe for us what process FDA goes through in assessing the safety of transgenic foods?

Dr. KESSLER. The Federal Food, Drug, and Cosmetic Act places the primary responsibility for ensuring the safety of foods on the developer of the product. FDA has established guidelines for safety assessment to assist developers to meet their statutory burden. FDA provided guidance for assessing the safety of foods derived from plants developed through recombinant DNA techniques—a transgenic plant—in the "Guidance to Industry" section of FDA's May 29, 1992, policy statement which I will provide for the record. The scientific principles that underpin our guidance were discussed in a comprehensive article published in the journal, *Science* which explains the kinds of scientific issues that developers should consider in assessing the safety of foods; when developers need to consult with FDA on safety or questions; and when premarket approval is required. Our guidance is based on the premise that foods currently on the market—fruits, vegetables, grains, and their by-products, food starch and vegetable oils, are accepted as safe and are, therefore, a benchmark to which new varieties can be compared.

We have developed a science-based approach for ensuring the safety of foods derived from new plant varieties. Using this approach, the new variety is evaluated in light of the safety of any newly introduced substances and any unintended increased concentrations of toxicants beyond the range known to be safe in food, alterations of important nutrients that may occur as a result of genetic modification, and any potential allergens. The approach focuses on the objective characteristics of the finished food. Substances that have a safe history of use in food and substances that are substantially similar to such substances generally would not require extensive pre-market safety testing. Substances that raise safety concerns would be subjected to closer inquiry.

Our safety assessment guidance focuses on knowledge of the plant being modified, characterization of the genetic modification, the characteristics of any organism from which donor genetic material has been obtained, the composition of the food in terms of important nutrients or toxicants, and the safety of any substances, such as proteins, fatty acids, or starches, that have been added to the food.

Scientific data are generally derived from molecular biological and chemical analyses of the new food. Animal feeding trials of foods derived from new plant varieties are not conducted routinely. However, in some cases, testing may be useful to ensure safety. For example, substances with unusual functions or that will be new macroconstituents of the diet may raise sufficient concern to warrant such testing. Tests could include metabolic, toxicological, or digestibility studies, depending on the circumstances. Developers may also find it useful to conduct tests on the "wholesomeness" of foods derived from new plant varieties as a means of ensuring that the food does not contain high levels of unexpected, acutely toxic substances. Such tests may be useful in providing additional assurance to consumers that food developed by new technology is as safe as food derived from existing varieties.

[CLERK'S NOTE.—The Federal Register publication appears on pages 924 through 946.]

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Mr. DURBIN. Is this similar to the IFBC approach? Are these standard toxicological testing methods?

Dr. KESSLER. The scientific approach to safety assessment discussed in the "Guidance to Industry" section of FDA's policy is consistent in principle with the approach proposed by the IFBC, although some differences exist. For example, the IFBC document's safety assessment scheme does not address the question of potential allergenicity, nor does it identify questions about which a firm should consult with FDA, such as test protocol design. The scientific principles of FDA's policy are also consistent with those of other prestigious bodies such as the WHO/FAO and the OECD.

FLAVR SAVR TOMATO

Mr. DURBIN. Let me go to a specific example which has been alluded to in the testimony from the Agricultural Research Service. There has been considerable discussion in the press about the Flavr Savr Tomato which was developed through biotechnology. The concept has been described very well, I believe, by Dr. Still about how they considered this to be a breakthrough. A tomato that remained on the vine longer to ripen had a better flavor and texture. And, yet, most of us read several months ago that a major food processor in the United States, which was somehow linked with this research, announced that they would not be using this tomato in any of their products. It led one to conclude that there was some consumer resistance to the idea of genetic-engineered fruits and vegetables. And although I have not seen a specific statement from the company to that effect, I think that is a safe conclusion, that they are concerned at this moment that the American consumers are not prepared to accept this.

I really would like to know what connection each of you have had with the development of this product, whether you understand the problem that this company ran into to be the same as I do and what we need to do to establish consumer confidence in the Flavr Savr Tomato or its progeny through this biotechnology research.

Dr. KESSLER. The bottom line, with regard to FDA's responsibility, is if that product is going to be on the market, we have to assure that the product is safe. The data on that product is currently under review at the agency.

If people do not have confidence in the process, if they do not believe that we are doing our job looking at that data, it becomes easy for those who just want to shoot down some of the new technology. It is very easy to generate fear of the unknown, fear of new products especially when you use words like biotechnology. You conjure up putting genes from animals into plants. If you put a gene outside of a tomato into a tomato, and that is not the case here, it is not going to become anything other than a tomato. With the whole notion of science fiction, we run a risk in this country because food is something we hold very dear, because we put it into our bodies. Anytime anybody tampers with it, anytime anyone makes any change, someone will say that that is not good. There are some very vocal folks who are against any kind of progress. But where would we be without the results of technology. But the bottom line is that what is going to be required is a system in

place, by which we can assure the safety of those products. That is the key. This is not an area where we are deregulating. If anything, we are talking about a relatively strenuous and strict area. We are not going to allow any products on the market that are not safe.

CONSUMER ACCEPTANCE

Mr. DURBIN. Dr. Plowman, I believe the testimony that we received earlier from Dr. Still suggests that the Flavr Savr Tomato was under license through public patent, I think is the reference that he made. Have you come across any similar reactions, from licensees or potential licensees to the question of consumer acceptance of genetically engineered fruits and vegetables?

Dr. PLOWMAN. That is a real problem. Everyone is concerned, as Dr. Kessler said, with the fear that something might be wrong, but it is not based in science. And I think that is our big challenge. How do we get over that perception? We cannot have a situation where we stop developing technology. What if we threw away all these tools. We have been accomplishing many of the things through other techniques in the past. We are not changing composition. The tomato has not changed in composition. It is the same thing that the people have been eating. We have just gone about it a different way, but, yet, there is all that fear. It is a real problem. We are going to have a real problem in adopting the products of biotechnology unless we overcome some of these perceptions.

[Additional information follows:]

The FLAVR SAVR tomato was developed entirely by private industry. The USDA did not play a role in the genetic engineering necessary to produce this particular tomato. The FLAVR SAVR tomato is based on technology developed both in England and by Calgene which was centered on the inhibition of the expression of the enzyme polygalacturonase ribonucleic acid which causes fruit senescence after ripening. Using a different approach, the ARS Plant Gene Expression Center has developed technology to control the gene that provides the enzyme that converts a natural precursor to the plant hormone ethylene, which is a trigger for the onset of tomato fruit ripening. The ARS has applied for a public patent as a result of this work and has subsequently licensed the technology to Calgene, and to other U.S. companies for their use in independently developing tomato products for U.S. and foreign markets. The FLAVR SAVR tomato presently being prepared for market by Calgene does not contain the USDA's ethylene gene. However, it is likely that by late 1994 or 1995 products could be presented that combine the ethylene and FLAVR SAVR genes such that both the onset of tomato ripening and senescence after ripening can be regulated.

Mr. DURBIN. Mr. Medley.

Mr. MEDLEY. Thank you, Mr. Chairman. I would like to echo the comments of Commissioner Kessler and Dr. Plowman, but also I would like to re-emphasize your point in terms of what do we do to assure public acceptance of these products. I think that is a fundamental issue.

One of the things I would like to say is that the system is very important but we must look at it as a totally integrated system. Here we are talking about not only efficient oversight and initial development and field testing, but commercialization as well. To further respond to one of your earlier questions, I think we have to have increased coordination among the regulatory agencies that are involved in each phase. We have to make sure that we continue to press for active public participation in the process and then

by doing that, hopefully, we can bring about better understanding and increased public acceptance. But it is quite a challenge. As Dr. Plowman stated, it is not one that is based in all cases on science; but instead we must deal with the fact that public perception can be as important or influential as scientific factors, and directly address that.

[Additional information follows:]

APHIS' involvement with the development of the FLAVR SAVR™ tomato has been at the field testing stage. Because some portions of the introduced genetic material and the transformation system used were derived from known plant pests, APHIS required a permit under its regulations in 7 CFR part 340 for the introduction (interstate movement and release) of the FLAVR SAVR™ until it could be determined that the tomato did not present a plant pest risk. In response to a petition from Calgene, Inc., developer of the FLAVR SAVR™, APHIS published an interpretive ruling on October 19, 1992, that tomato plants containing the FLAVR SAVR™ gene are no longer considered regulated articles under APHIS' regulations. In arriving at a determination on the Calgene petition, APHIS considered extensive data and other scientific information submitted by Calgene, as well as public comments, scientific literature, and expert opinion.

Mr. DURBIN. Dr. Jordan.

Dr. JORDAN. Would I be allowed perhaps, Mr. Chairman, to reemphasize a point? Namely, that we are almost ready to unfold a consumer information and education program that is designed specifically to present the good, the bad, and the ugly. Just how it is, so to speak. Perhaps this will help, but it will never replace the kind of interaction that Mr. Medley and Dr. Kessler have already discussed. But at least it will be an additional help to have information readily available to the citizen in general about biotechnology.

[Additional information follows:]

The Cooperative State Research Service has had no direct role in the development of the FLAVR SAVR tomato. The Office of Agricultural Biotechnology has provided public information about the FLAVR SAVR tomato in response to inquiries from interested parties.

REGULATORY COORDINATION

Mr. DURBIN. Well, there is a big educational effort here obviously and I think that is what everyone is alluding to. And I think many people, myself included, who are as I often say, liberal arts majors, did not take the necessary biology and chemistry courses to closely follow you. When you start talking about gene splicing from fireflies to corn plants, from animals to plants and so forth, it really raises a question in my mind if this is the natural order of things or whether we are somehow interrupting it and what the ultimate impact will be not only on consumers, but on generations beyond us. What are we leaving as our heritage from this kind of scientific endeavor? I think that what consumers are looking for are assurances from reliable scientific non-political sources that the information being given is accurate and that the products on the table for their families are safe. Once having received that assurance, they are prepared to accept them. But I think we are just at the threshold of entering into that and I think that is why I have called this hearing, obviously, but I think that is why we have got to continue to try to address it.

Mr. Medley, you talked about more coordination. I get a little nervous when we talk about that because as Dr. Jordan went through the long list of acronyms and agencies, and I looked through the literature, among federal agencies you can certainly see that there is jurisdiction for certain aspects of genetic engineering in the USDA, the FDA, the National Institutes of Health, OSHA, and EPA, to name a few. There are probably many other agencies which I have missed. And I am wondering are you talking about some super coordinating council here or what?

Mr. MEDLEY. No, sir, I am not. What I am talking about is that when we speak of biotechnology, we are talking about a whole array of different tools. Those different tools have applications across many different established industries or sectors. When you have that type of cross-utilization it becomes even more important to prevent duplication, to prevent multiple reviews, and to have agencies with jurisdiction clearly delineating their responsibilities and how they will interact. That is not only to assure safety but also to prevent duplication.

Mr. DURBIN. How do we achieve that?

Mr. MEDLEY. Through some of the things I talked about earlier, such as the efforts that have been occurring for the past six years between the three major regulatory agencies, FDA, EPA, and USDA, to do exactly that. I think what you see is that our authorities are aimed at different areas and different applications.

I spoke earlier this morning about our role in assuring that crops are safe to grow. Dr. Kessler talked about the safety to consume. We know that EPA has a responsibility with respect to pesticides. So I think that we have developed the necessary working relationships, and through increased coordination we can build upon that. That is one of the aspects.

Mr. DURBIN. Does the USDA have a problem in that it is both promoting biotechnology and regulating biotechnology?

Mr. MEDLEY. Mr. Chairman, that has been asked on a number of occasions. I believe that the answer depends upon how one looks at good effective government regulations. I believe that good regulations remove regulatory uncertainty. They provide very clearly the standards that must be met for development. To me, that also serves as a catalyst for technology transfer. So I believe that good regulations do both protect and facilitate. I do not believe that that is a conflict. It should be noted that the Department of Health and Human Services both promotes NIH and regulates FDA biotechnology products as well.

TRANSGENIC ANIMALS

Mr. DURBIN. Let me ask you a specific question. In my visit to Beltsville yesterday I met with a gentleman towards the end of the day, Mr. Wall. Was it Dr. Bob Wall?

Dr. PLOWMAN. Bob Wall.

Mr. DURBIN. Bob Wall, yes. We discussed some of his research on transgenic animals. And it was interesting. He said after the experiment the animals were destroyed. They were not allowed to propagate, not put out in general animal populations. Is that the rule? Is

that the standard? That if you have a transgenic animal that it is not allowed to join the flock afterwards?

Mr. MEDLEY. I touched on this very briefly in my prepared text about the policy being developed by the Food Safety and Inspection Service on transgenic animals. The current procedure is that those animals that are used in research are considered experimental animals under the Food Safety and Inspection Service regulations and they must be dealt with accordingly.

Mr. DURBIN. Meaning?

Mr. MEDLEY. Meaning that the policy decision on whether or not those animals should be destroyed or allowed to go to slaughter is being developed by the Food Safety and Inspection Service. They recently had a meeting with our advisory committee that Dr. Jordan talked about to further delineate the issues which need to be resolved prior to the broad scale use of those animals.

Mr. DURBIN. So is it on a case-by-case basis that such a decision is made?

Mr. MEDLEY. Currently, it is not only on a case-by-case basis, but we would look at the gene animal combination to see what is the nature of the genetic change that would determine which subsequent regulatory requirements would have to be met. Whether it falls under the purview of FSIS or is viewed as an animal drug which comes under the jurisdiction of the Food and Drug Administration, is currently under discussion by agencies to clarify that policy.

Mr. DURBIN. Are there any international standards on this within the scientific community? Any acceptable standards that we are trying to build on here? It would seem to me that if we have a concern in the United States some other countries might have similar concerns.

Mr. MEDLEY. True. There are. There are a number of international forums that are addressing these issues. One of the most active is a forum called the Group of National Experts at the Organisation for Economic Cooperation and Development in Paris. I am also glad to say, though, that I believe the United States clearly, in terms of its science, is a world leader and a lot of countries are looking to us to establish those baselines.

GENETICALLY ENGINEERED ANIMALS

Mr. DURBIN. In early February it was announced that the Federal government would again start issuing patents on genetically engineered animals. Does the research on any of these animals have to be approved by a Federal agency prior to the onset of the research?

Dr. KESSLER. Research involving genetically engineered animals that receives funding from a Federal agency must be approved by the funding agency prior to initiation of the research. The National Institutes of Health Recombinant DNA Advisory Committee and the Agricultural Biotechnology Research Advisory Committee are advisory bodies utilized by Federal agencies to assist in evaluating the designs of studies involving genetically engineered animals. Privately funded research involving genetically engineered animals does not have to be approved by any Federal agency prior to onset.

Private researchers, however, may request Federal oversight or guidance on a voluntary basis.

Federal oversight of research activities is required once research extends beyond the laboratory setting. At this point, the genetically engineered animal is considered to contain an unapproved new animal drug and, thus, the added substance is subject to regulation by FDA. The investigator would be required to establish an investigational new animal drug file with FDA. FDA then monitors the sponsor to ensure that the process, the animal and the products derived from genetically engineered animals were not being offered for sale or use by the consuming public. Measures taken to prevent environmental impact, such as containment, would be established and monitored under the INAD as well. If the sponsors of the research wanted to market the process, the animals or the products derived from genetically modified animals, they would have to obtain FDA approval to do so. In this case, all pivotal studies conducted to satisfy requirements for approval would have to be approved by FDA.

RECOMBINANT DNA

Mr. DURBIN. In discussing recombinant DNA you state that recombination occurs naturally: "It is the key to genetic diversity." What is the difference between recombinant DNA and genetic improvements through traditional breeding programs, other than the time it takes to accomplish the desired goals?

Dr. PLOWMAN. Classical breeding programs involve the crossing of individual plants or animals which results in thousands of natural recombinations of their genetic material. Subsequent selection of progeny that express or display the desired trait or traits results in genetic improvements. In contrast, recombinant DNA technology can introduce specific genes or gene sequences of interest without extraneous DNA material. Natural recombination occurs between paired chromosomes of the same organism, but recombinant DNA technology can be used to transfer genes or fragments of DNA from the same organism or from other species in the plant or animal kingdom. In other words, desirable genes from foreign organisms can be introduced and recombined with the native DNA of an organism. Stated another way, traditional breeding technologies bring the entire informational genome of the male and female parents together so that not only are the genes of interest transferred, but enormous amounts of donor DNA are transferred. The power of recombinant DNA is that not only can one alter the recipient genome with a very small percentage of new information, but also there is complete knowledge as to every part of the foreign gene placed in the recipient genome. The use of recombinant DNA provides our scientists with a new approach for improving crop production, animal agriculture, and bioprocessing in a more expedient manner.

ENVIRONMENTAL RISKS

Mr. DURBIN. What would be the difference in environmental risks from a genetically altered food, from a genetically altered

plant or animal, and plants or animals that are developed through the more traditional breeding methods?

Dr. PLOWMAN. Transfer of DNA intraspecifically using genetic engineering techniques as opposed to a similar transfer of DNA using the more traditional breeding methods should not result in a difference in environmental risk in terms of a genetically altered food. All of the isolated DNA presented to a recipient genome can be well-defined, characterized, and understood. Therefore, there is not likely any increased environmental risk from using the recombinant DNA technologies under these circumstances, and one could argue that there is a far less probability of environmental risk inasmuch as the actual transferred material is much less and better defined using recombinant DNA technologies than by using conventional breeding methods. Although in some cases recombinant DNA technology requires the use of so-called reporter or marker genes such as antibiotic resistance and others, within the last year technology provided by the Agricultural Research Service has enabled molecular biologists to tag the reporter genes in such a manner that they can be identified in the final recipient genome. At that time, the reporter genes may be removed and only the genes of interest will remain in the engineered plant or animal material. This will allow breeders and geneticists to now use molecular biology to not only move genes into the host genome, but to also be further assured that the material that goes into the agricultural environment contains only those genes of interest and none of the genes that are required as tools for the transfer technologies. This will cause even greater reduction of suspected environmental risk from genetically altered plant or animal foods. With respect to moving genes across unrelated life forms, which is generally not the case in traditional breeding methods, there should still not be an increase in environmental risk as long as the DNA is well-defined, characterized, and understood. ARS is not aware of any information to suggest that the application of recombinant DNA techniques to the development of new plants or animals would result in foods which exhibit attributes different from foods derived by other methods of plant breeding. USDA has implemented a biotechnology risk assessment grants program that is aimed at assessing the environmental risk associated with a variety of genetically engineered life forms. This program is being used to further the knowledge in many areas including genetically altered food plants and animals.

PLANT AND ANIMAL GENES

Mr. DURBIN. There has been considerable discussion as to the possibility of transferring animal genes to plants. Are there animal genes that occur naturally in plants and vice versa?

Dr. PLOWMAN. Animals and plants share some genes which are required for ancestral and thus common function. The genetic codes for these common genes are very similar. The biochemical pathways for oxygen metabolism, for example, utilize conserved genes. In contrast, animal-specific or plant-specific functions are more likely to be mediated by unique genes. It is unlikely that

there are genes that are exactly the same in nucleotide sequence between plants and animals.

Mr. DURBIN. Are there genes that occur in humans that also occur in plants? If so, please describe some of these genes.

Dr. PLOWMAN. The genes that produce the basic reactions for life are similar between plants and animals. Examples of genes with a great deal of similarity are the genes for conversion of sugar to energy. This multi-step process depends on about 20 genes which have a great deal of similarity between plants and animals.

Mr. DURBIN. It has been said that cattle have approximately 80% of the same genes that humans have. Is that a correct statement and are the genes truly interchangeable?

Dr. PLOWMAN. The exact number of genes that are the same between humans and cattle is not known, but could possibly be as high or higher than 80%. Mapping of human and cattle genes reveals similar groupings on chromosomes. Analyses of sequences of bovine genes suggest that many have similar function and structure to human genes. Some gene products from animals, such as porcine insulin, work well in humans. The degree to which genes are "interchangeable" is not known, although portions of some genes are likely to be.

PATENT ISSUES

Mr. DURBIN. I have one question related to the testimony, Dr. Plowman, that some of your witnesses gave. It is clear that in some areas we are putting patents on these developments, these genetically engineered crops and the like. And then we go on to license them. Flavr Savr Tomato is an example of that. Yet, when I visited Beltsville yesterday I believe Dr. Lawson, who is involved in horticulture, indicated that there were no patents on flowers and ornamental plants. And he suggested to me that this is something we might consider. He thought that the industry itself would be supportive of the idea. Do you have any idea, or perhaps some of your people who join you today, as to whether that is being explored and what the pros and cons might be?

Dr. PLOWMAN. Yes. We are exploring that now. In the past our philosophy has been and the philosophy of patenting is to facilitate commercialization. A number of companies would not take on something unless they were given exclusive rights to that so they could market it. And that has been the philosophy in plants. So there have been very few plants patented and marketed that way.

Now, Dr. Lawson as he interacts with the floral industry is of the opinion that we need to develop plant protection and exclusive licensing to get some companies to take up plants, too. We are evolving in philosophy and regulations about the plant patenting issues and it is a very contentious situation right now.

What we would like to do is prevent the control or the locking up of genetic material for future use since we need to keep plant germplasm free for continued improvement. But at the same time we need to provide a mechanism so that the people that are involved with that can recapture at least their investment costs. It would be a tragedy in some plants, for example, if by the use of plant biotechnology or whatever, we had some new varieties with

some very specific traits but no one else was ever allowed to use those for continued breeding and improvement. So we have got to come to some kind of an agreement.

Mr. DURBIN. That is the dilemma we face.

Dr. PLOWMAN. That is the dilemma.

SOYBEAN GERMPLASM

Mr. DURBIN. An example, in my part of the world, is soybean germplasm.

Dr. PLOWMAN. Exactly.

Mr. DURBIN. The National Soybean Research Lab at the University of Illinois has some 15,000 different types of germplasm.

Dr. PLOWMAN. That is right.

Mr. DURBIN. The Chinese have 35,000.

Dr. PLOWMAN. That is right.

Mr. DURBIN. We would like to get some of their germplasm into the United States and I am sure they would want to know before they sent it whether it was going to be patented and commercialized.

Dr. PLOWMAN. That is right.

Mr. DURBIN. And, if so, what the impact would be. So it sounds to me like we have got some more thinking to do along those lines.

Dr. PLOWMAN. We have. We have written a paper this last year that sets forth a proposal to adopt, at least in the public sector, and we are working now with the universities to see if we can get some agreement on that philosophy. Again, trying to keep germplasm free for continued exploration, but at the same time reward development and commercialization.

NATIONAL BIOLOGICAL IMPACT ASSESSMENT PROGRAM

Mr. DURBIN. I have a question for Dr. Jordan. And, first, by way of comment I might alert my colleagues on the Subcommittee that our friends from the dark ages, the Pork Busters, have identified the National Biological Impact Assessment, the program which you have described at length, as one of those wasteful areas of Federal spending. Some $300,000 they want to rescind because they think it is unnecessary for us to have this kind of computer information available to the scientific community across the United States. What the Luddites were to machinery I think the Pork Busters are to the idea of progressive research. I would urge everyone present, especially my colleagues, to think long and hard before they give any credibility to our friends who have become the self-anointed and self-appointed Pork Busters. I guess if we left research in their hands we would still be using candles.

Dr. JORDAN. The National Biological Impact Assessment Program—NBIAP—was established specifically to facilitate the safe application of biotechnology to agriculture and the environment. It is a research support program concerned with agricultural biotechnology safety, both environmental and public health.

We believe that NBIAP represents an important innovation in organizing information for the scientific community, both public and private. When we established the program we visited with university and biotechnology company scientists to ask them what sort

of support would be most useful in facilitating the safe application of biotechnology to agriculture and the environment. We were told by that representative group that access to information was one of the primary needs they had, especially with regard to regulatory compliance, new opportunities in biotechnology research, resources available, and other pertinent information.

Using the knowledge and skills available through a network of partner Land Grant Universities NBIAP has created and offered to the national scientific community, an enormous resource of information on biotechnology and biosafety through (1) a computer bulletin board and databases and (2) a computer mediated system for designing safe field tests, drafting applications for Federal permits, and reporting the biosafety results. The latter computer software uses sophisticated programs to assist permit applicants by presenting carefully prepared prompts to the applicant and then capturing the responses. The software is said to have greatly reduced the burden of the permit application process and thus improves U.S. research capacity in biotechnology while enhancing protection of public health and the environment.

Although the electronic information system is perhaps the most visible aspect of the program, NBIAP also provides numerous other services and support activities in fulfilling its mission to further agricultural biotechnology. For instance the program offers direct support for research activities, conferences, training workshops, and teaching materials with the intent of facilitating the safe application of biotechnology to agriculture and the environment. The program's emphasis throughout is on ensuring that biotechnology is applied to agriculture with due regard for the environment and public health.

The special research grant funding that supports the program is especially appropriate to NBIAP as it can target and support specific activities within the university research community. Far from being "Pork Barrel", the modest funds for NBIAP are carefully matched to projects to develop computer software for specific needs, gather information, or organize and distribute knowledge for the benefit of the broad scientific community under the aegis of a USDA award winning strategic plan.

Discontinuing the services of NBIAP would be a major setback for a scientific community that depends on this program for a spectrum of information services, and resources which are used to advance the safe application of biotechnology to agriculture. The program regularly surveys user groups to ascertain interest and to determine the value of the program's offerings. The program has always received high marks from the now more than 6,900 users of the systems. Termination of the program's services would cut-off many scientists from needed information and this could contribute to a lessening of compliance with Federal biosafety regulations, slow down the pace of the application of biotechnology to agriculture and the environment, and diminish an enormous national investment in agricultural biotechnology research that has clearly visible benefits for agricultural producers, consumers, and our national interest in global competitiveness.

BIOTECHNOLOGY RISK ASSESSMENT RESEARCH GRANTS PROGRAM

Mr. DURBIN. The Biotechnology Risk Assessment Research Grants Program, which was authorized by section 1668 of the Farm Bill, is designed to help address concerns about the effects of introducing certain biotechnology products into the environment and to help regulators develop policies concerning the introduction of such products. You state that in fiscal year 1992 the program awarded $1.4 million for eight research projects. Please list for the record each of these projects.

Dr. JORDAN. The eight grants awarded during fiscal year 1992 for the Biotechnology Risk Assessment Research Grants Program will be provided for the record.

[The information follows:]

Title: Stability of Disabled Viroid Sequences in Transgenic Plants: Generation of Wild-type Viroids via Sequence Reversion and Recombination. Principal Investigators: Robert A. Owens, Rosemarie Hammond, Theodor Diener. Institution: USDA/ARS, Beltsville; Recommended Funding: $56,200; Period: 24 months.

Title: Risk Assessment of Virus Spread Using Transgenic Plants Containing Viral Coat Protein Gene. Principal Investigator: Dennis Gonsalves; Institution: Cornell University—Geneva; Recommended Funding: $98,196; Period: 24 months.

Title: The Impact of Patchiness and Life Strategy on Spread of Phyllosphere Bacteria. Investigator: Susan Hirano; Institution: University of Wisconsin; Recommended Funding: $148,289; Period: 24 months.

Title: Assessing Horizontal Gene Transfer from Rhizosphere Microorganisms to a GEM. Principal Investigator: Stephen K. Farrand; Institution: University of Illinois; Recommended Funding: $220,000; Period: 36 months.

Title: Rhizopine Synthesis and Catabolism Genes for the Creation of "Biased Rhizospheres". Principal Investigator: Frans J. de Bruijn; Institution: Michigan State University; Recommended Funding: $225,000; Period: 36 months.

Title: Genetic Risk Assessment of Tobacco Budworm Resistance to Transgenic Bt-toxin. Principal Investigator: David G. Heckel; Institution: Clemson University; Recommended Funding: $230,000; Period: 36 months.

Title: Predator Avoidance, Spawning, and Foraging Ability of Transgenic Catfish. Principal Investigator: Rex Dunham; Institution: Auburn University; Recommended Funding: $217,391; Period: 36 months.

Title: Spread of Transgenic Weeds with Resistance to Herbicide. Principal Investigator: Joy Michele Bergelson; Institution: Washington University; Recommended Funding: $209,294; Period: 36 months.

Mr. DURBIN. You also state that you anticipate that $1.7 million will be available for award in fiscal year 1993. A solicitation for proposals has been prepared and published in the Federal Register. What comments have you received on these proposals for fiscal year 1993?

Dr. JORDAN. The U.S. Department of Agriculture published in the March 1, 1993, Federal Register proposed procedures for the administration of the Biotechnology Risk Assessment Research Grants Program. That publication received three comments that raised specific points regarding the grant program's areas of funding; the process of proposal review; and support for the option for using preproposals as a preliminary screen prior to potential full-scale application. Responses to these comments are now being prepared and revisions to the final procedures are being developed and will then be published in the Federal Register as the final procedures.

In addition to the proposed procedures, the Department published in the April 14, 1993, Federal Register a solicitation for proposals for fiscal year 1993 using interim procedures for the administration of the program. No comments were requested on this solicitation as it was an announcement of availability of funding and a request for proposals, which are due June 14, 1993. Proposals received in response to this request will be reviewed by a peer panel of scientists and will be awarded competitively, as per the intent of section 1668 of the 1990 Farm Bill.

ELECTRONIC BULLETIN BOARDS

Mr. DURBIN. Let me ask you this in specific terms. You have talked about electronic bulletin boards and I have been told recently that someone with a modem and a computer at home has access to an abundance of information which increases daily in terms of available databases. Most of it is free for those who have a telephone and the technology to get into these bulletin boards. Is there any discussion about assessing any charge to people who use this information?

Dr. JORDAN. At the beginning of our networking, of course, we wanted to make sure that the research laboratories were all hitched together and there was no interest in that. In terms of making it broadly available, which it is now, to so many other people I do not know if there is any charge at all, Dr. MacKenzie, for that or if there is any discussion about it as it has evolved. It has only been in operation about what? Three years or so?

Mr. DURBIN. Sure, go right ahead, Dr. MacKenzie.

Dr. MACKENZIE. We discussed this point at great length when we were setting the program up. Having been a former university professor myself and talking with other professors, I was well aware of the difficulty in getting purchase orders cut with any university to subscribe to something that may cost a small amount of money over the course of a year. We decided that in the interest of getting the program underway and making it broadly available, that we would provide it free of charge to the scientific community.

The mechanism we use for registration now is that they pay for the first phone call to Blacksburg, Virginia, where the computers are located. These are relatively small computers that are linked together. We are talking desktop computers that run this system. Fast computers, but not expensive. After they have paid the first toll phone call and we have screened them as legitimate users, including not only active scientists, but young budding scientists who could include even some from high schools that are interested in what they are doing, we permit them access to the computers over an 800 number. Our phone calls total for the entire system per year something less than $30,000 to provide all this information for what was as of Friday 6900 users. We give them access to all sorts of information. Just as one example, an entire text from 7 CFR 340, the regulations for plant biotechnology from APHIS, are on there for them to have and read. We have 18 databases that provide all kinds of information.

The reason we have done this is the crying need, as we asked the scientists five years ago when we set the program up, "What do

you want the most?" And they said, "Access to information. It is so hard for us to get it." That is why we have done it. It is under constant review.

Mr. DURBIN. Thank you, Dr. MacKenzie.

Dr. JORDAN. I might just close by identifying what we use the $300,000 for. It is basically for the development of the databases and putting it into motion, testing it and those kinds of things.

BIOTECHNOLOGY AND FOOD SAFETY

Mr. DURBIN. What will be the role of biotechnology in making foods safer? For example, through biotechnology will we be able to reduce naturally-occurring toxins and allergenic proteins?

Dr. PLOWMAN. Biotechnology can play a significant role in making foods safer, as you suggest, through the reduction of naturally-occurring toxins and allergenic proteins. Because biotechnology allows precise changes to be made in the plant or animal genome, the desired changes can be made without affecting any other desirable characteristics, as might be the case with changes brought about through traditional breeding methods. And as agricultural scientists better understand the coding, expression and gene regulation of agriculturally-important plants and animals that provide food, they will also understand the mechanisms by which naturally-occurring molecules evolve. Most of these naturally-occurring materials are part of a biological strategy for defense and for recognition that have evolved within the biological development of plants and animals. Most of the toxins of plants have evolved as defense mechanisms to reduce attack by pests. The same toxins are also in some cases deleterious to man. Through biotechnology and an understanding of the mechanisms through which these substances are produced, agricultural scientists should be able to alter their expression while maintaining the productive capabilities of the agricultural plants.

PUBLIC ACCEPTANCE

Mr. DURBIN. While each of your four agencies have a role in seeing that genetically engineered foods are safe, what role, if any, do each of you play in working to promote public acceptance of these foods? Also, do you feel it is appropriate for the government to take on such a role?

Dr. PLOWMAN. If biotechnology for agriculture is going to be used in world agriculture it will be imperative that the public have a full understanding of not only the methodology but the impact of that methodology upon their food, fiber, and other agricultural products. While the ARS has no formal role in bringing about public acceptance of changes in foods made possible with any kind of agricultural technology, the ARS scientists do present their research findings in public professional forums, both in open meetings and in peer reviewed journals. ARS scientific developments are also presented in the monthly magazine, Agricultural Research, which is written for the general public. Both of these avenues initiate and support the process of public knowledge and acceptance. Some State Experiment Station workers are beginning to put together programs centered on education in terms of biotech-

nology, and are addressing the issue of public education. Both public and private institutions should increase their proactive stance in this area. It is incumbent upon science to articulate its technology to the public in a way that is understandable.

Dr. JORDAN. We do not get involved in promotion, but we do play a role in providing objective, unbiased information about the benefits, risks, regulatory safeguards, and other aspects of agricultural biotechnology to the public. This appears to be an appropriate activity in keeping with the statutory responsibility of the Department of Agriculture "to acquire and diffuse among the people of the United States useful information on subjects connected with agriculture . . .".

Mr. MEDLEY. While APHIS' mandate under the Federal Plant Pest Act and Plant Quarantine Act is to prevent the introduction and dissemination of plant pests, APHIS is also required under the provisions of the National Environmental Policy Act to assess the effects of its actions on the human environment. Accordingly, under its authority in 7 CFR part 340, APHIS announces the receipt of all permit applications for field release in the Federal Register. Before approving a field test, APHIS performs an environmental assessment (EA) of each proposed field test and announces the availability of the EA in the Federal Register. In addition, APHIS routinely makes available lists of permits issued to the public upon request, and responds to requests for public appearances to discuss the field testing of genetically engineered organisms. APHIS has also sponsored a series of national conferences designed to inform State officials of the range of issues associated with agricultural biotechnology. APHIS believes that providing the public with information about the organisms and products regulated under its authorities is entirely appropriate and necessary.

FOOD DEVELOPMENT COSTS

Mr. DURBIN. It was recently reported at a biotechnology seminar that development costs of a food is five times higher than most food categories could tolerate. If that is true, it would seem that there is no economic case to be made to develop biotech foods. We are curious whether the additional cost of regulatory activities is causing the biotech foods to be so high in development?

Dr. PLOWMAN. While I do not know specific amounts, I do agree that costs to develop genetically altered foods are very high. I do not believe that the Food and Drug Administration has placed undue regulatory burdens on such foods. I would also note that APHIS published regulations for field testing of transgenic plants in 1987. Since that time, over 400 controlled field tests of transgenic plants have been conducted. Based on this experience, APHIS has established a notification procedure, effective April 30, 1993, that will reduce the time and paperwork required to secure approval to move or release a transgenic plant. As additional experience is gained and public confidence in biotechnology products increases, APHIS expects that the amount of regulation and its cost should be reduced accordingly. In any event, carrying out the scientific procedures necessary to develop the foods are very extensive and costly. The industrial sponsors are responsible for the safety of the

product they produce, even though the FDA does not impose extensive premarket clearance procedures. Thus, the sponsors are extremely thorough in the tests they carry out to assure safety to both the consumer and to the environment. This will likely restrict the use of genetic alteration to major food crops, such as tomatoes, lettuce, broccoli, corn, wheat, soybeans, peanuts, oranges and others. The smaller volume fruits and vegetables most probably will not economically warrant genetic alteration, irregardless of the potential benefits.

Mr. DURBIN. We are aware that much of the work related to biotechnology on the development of crops is targeted toward resistance to herbicides. In fact, there are some reported cases where progress has been made in this area. It would seem logical that if a plant is capable of becoming resistant to herbicides, that it would allow the farmer to apply more herbicides to the ground. Is this doing potentially more environmental damage to groundwater in the surrounding area? Is that scenario correct? If so, what is the benefit to the general population from biotechnology under that scenario?

Dr. PLOWMAN. Since all plants have a degree of natural resistance to certain herbicides, plant breeders can use either conventional or biotechnology techniques to develop herbicide-resistant crops. We do not believe, however, that the proper use of herbicides on herbicide-resistant crops will increase environmental damage to the groundwater in surrounding areas. While ARS does not have a research objective to develop herbicides or herbicide-resistant crops, we can see advantages to their development by the private sector. With crop varieties resistant to foliar-applied herbicides, the farmer can wait until crop and weed seedlings emerge from the soil and then apply herbicides only to those areas in the field where weed problems exist without concern for potential damage to the crop plants. Relatively low amounts and concentrations of foliar herbicides could be used. A common practice now is to apply herbicides to the whole field prior to planting and without knowledge of where weeds will become a problem. This is one reason why herbicides account for about 70 percent of all pesticides used on U.S. cropland. Use of herbicide-resistant varieties could easily reduce the acreage treated with herbicides as well as total volume of herbicides used. The other advantage of herbicide-resistant crop varieties that often is overlooked is the freedom to rotate crops so that soil residues of herbicides will not damage subsequent susceptible crops. Crop rotation is recommended and widely used in the U.S., and even small amounts of herbicide residues in the soil can substantially reduce yield and quality of herbicide-sensitive crops. There is too little actual use of herbicide-resistant crops at the present time to collect data on potential impact on groundwater quality. However, we know that foliar herbicides such as those to which crops are being made resistant pose much less of a treat to groundwater than soil-applied herbicides currently used on those crops. Proper use of herbicides on herbicide-resistant crops may be a way to actually reduce potential pollution of our groundwater. Use of foliar herbicides is a valuable tool to allow conservation/no-till production systems which are essential to control soil erosion.

GENOME MAPPING

Mr. DURBIN. You state that a major portion of the NRI funding goes to genomic mapping and that this ongoing effort complements the human genome effort of the National Institutes of Health and the Department of Energy. How do the Department's mapping of plant and animal genomes complement the human genome mapping project?

Dr. JORDAN. National Research Initiative—NRI—funding for plant genome mapping was $12.3 million and animal genome mapping was $5.7 million in 1992 within the total $97.5 million NRI program. The Department's mapping of plant and animal genomes complements the human genome mapping project and, incidentally, the human genome mapping project also contributes to the efforts of the plant and animal genome studies at several levels. Due to shared sequences, data from one species may be directly relevant to another species. Thus, information gained in any of the mapping projects could prove very useful for other mapping projects. For example, a gene's identity or sequence determined for one species may need only to be confirmed for another species. Similarly, the technologies used in genome mapping are similar irrespective of species. One goal of the Plant Genome Program is to foster development of new mapping, cloning and sequencing technologies. Several of the projects under way, if successful, will be applicable to all species. Further, the two mapping efforts are complementary in the area of software development pertaining to the management and interpretation of the resulting data.

Mr. DURBIN. Please list for the record all the plant and animal genomes that are currently being mapped and how far along each of the mappings are.

Dr. JORDAN. Completion of even broad genomic maps of all of the large number of agriculturally important plant species is currently beyond the resource capability available. Consequently, mapping efforts have been focused on obtaining highly resolved maps for a few species such as corn, wheat, soybean, cotton, tomato and pine. Some of these maps are much further along than others, partly because of the previous genetic information which was available, for example, corn and tomato. Genomic maps of pine, in contrast, for which little genetic background information was available are still in early development.

For many of the other crop or forest species, the maps under study are either broad maps or maps of a specific region of the genome where traits of agricultural importance reside. These maps are in various stages of development. The species currently being mapped include alfalfa, asparagus, bean, barley, cabbage, carrot, citrus, cottonwood, cucumber, flax, lettuce, onion, pea, peanut, peach, pepper, potato, rice, rye, strawberry, sweet potato, sunflower and tobacco.

As concerns animal genome mapping, there are groups producing maps for the following food and fiber animals: cattle, swine, sheep and chicken. For each, there is a formal group that has a species coordinator. Some fine mapping has been done in each of the four species; a broad map is closest to completion for cattle. Other studies are in progress on horse, goat, turkey, quail, catfish and trout.

BIOTECHNOLOGY RESEARCH

Mr. DURBIN. You state that through biotechnology bacterial strains have been developed which enhance nitrogen fixing capabilities which, in turn, can increase soybean yield without the use of nitrogen fertilizers. Where has this research been carried out and how close is it to commercialization?

Dr. JORDAN. The research is proceeding slowly as much of the basic biology of competition of microbes in natural settings is not well understood. Some field tests with genetically modified strains of nitrogen fixing bacteria have been undertaken and the results have been mixed. Scientists conducting the research still believe that possibilities exist for creating superior strains of nitrogen fixing bacteria, but the prospects for developing commercially successful strains are not immediate, and the effort will quite likely require more investment in pre-commercial stage research. I will provide the research location for the record.

[The information follows:]

Research on nitrogen fixation with soybeans is being undertaken at several universities and at one ARS laboratory: University of Arizona; University of California—Berkeley; University of California—Davis; Stanford University; University of Georgia; University of Hawaii; Iowa State University; Louisiana State University; University of Maryland—Eastern Shore; Michigan State University; University of Minnesota; University of Missouri; University of New Hampshire; Dartmouth College; New Mexico State University; North Carolina State University; Ohio State University; Oregon State University; Pennsylvania State University; Clemson University; University of Tennessee; Texas A&M University; Washington State University; University of Wisconsin; and USDA/ARS—Beltsville, MD.

ETHANOL FUELS

Mr. DURBIN. You also state that work is proceeding on a method of converting low-value crop residues into ethanol fuels that could be sold for 90 cents per gallon. Who is conducting this research and how close is it to commercialization?

Dr. JORDAN. The Michigan Biotechnology Institute—MBI—reports that they have licensed two technologies that, when combined, can provide a process for converting low-value crop residues into ethanol fuels. One process expands the fibers of crop residues which are commonly tightly bound and thus not available for enzymatic action. The second technology is an efficient system for enzymatically converting complex plant molecules into simple sugars which can then be converted to ethanol. These bioprocessing technologies are said by MBI to be extremely low-cost because of the source of the organic matter—crop residue, manure, and other agricultural by-products—, combined with a highly efficient bioprocessing system using enhanced microbial strains.

There are several remaining research questions regarding how best to combine these technologies and make them commercially successful. It is not possible at this time to estimate the remaining necessary research activities, but MBI has committed its resources to sustained effort in this area leading toward commercialization.

OFFICE OF AGRICULTURAL BIOTECHNOLOGY

Mr. DURBIN. The Department of Agriculture has established an Office of Agricultural Biotechnology to provide staff support to the

Committee on Biotechnology in Agriculture. For the record please provide a table showing for the past three years how much in staff-years and resources has been used for the Office of Agricultural Biotechnology.

[The information follows:]

STAFF-YEARS AND FUNDING FOR OFFICE OF AGRICULTURAL BIOTECHNOLOGY

[Dollars in thousands]

	FY 1990	FY 1991	FY 1992
Staff-years	5	6	8
Funding	$450	$519	$631

U.S. SUPPORT FOR BIOTECHNOLOGY

Mr. DURBIN. How does the United States, with respect to the resources devoted to biotechnology in agriculture, compare to other countries of the world?

Dr. PLOWMAN. U.S. Federal support of all areas of biotechnology is currently valued at $3.76 billion with agricultural biotechnology research comprising $289.4 million of that total. World-wide figures are more difficult to obtain, but the European Community member states—12 members—devote over $2.2 billion to all areas of biotechnology; somewhat over one-third of this amount is related to agriculture, food and the basic agricultural sciences. Also, the Commission of the European Community government is investing another $200 million over a four-year period that commenced in 1991 for agricultural biotechnology, and an additional amount of $30 million is devoted solely to food biotechnology. In Japan, the Ministry of Agriculture, Fisheries and Forestry has appropriated $88 million to its agricultural biotechnology effort for CY 1993. Countries such as China, Australia, Brazil and others have substantial investments directed at agricultural biotechnology, but we are unable to quantify these investments. The U.S. Department of Commerce Technology Administration predicts that by the year 2000 the U.S. will be losing the biotechnology lead to Japan, if we fail to keep pace with the strategic actions and research investments of the Japanese and other foreign governments. Japan has made achieving a leadership role in biotechnology by the year 2000 a national priority, as has the European Community. An issue central to the competitive position of U.S. efforts in biotechnology is a sufficient and stable level of funding for areas of science crucial to the field.

AGRICULTURAL BIOTECHNOLOGY RESEARCH ADVISORY COMMITTEE

Mr. DURBIN. Please provide a list of the members of the Agricultural Biotechnology Research Advisory Committee. Also provide information as to when this committee met and how much it has spent annually for the past three years.

Dr. JORDAN. The annual expenditures for the committee have been: $151,140 in Fiscal Year 1992; $129,515 in Fiscal Year 1991; and $148,000 in Fiscal Year 1990. The current list of members and

the meeting dates for the past three years will be provided for the record.

[The information follows:]

United States Department of Agriculture, Agricultural Biotechnology Research Advisory Committee List of Members, April, 1993

A. David Kline, Ph.D., Chair, State University of New York.
Anne K. Vidaver, Ph.D., University of Nebraska.
Robert T. Fraley, Ph.D., Monsanto Company.
Walter A. Hill, Ph.D., Tuskegee University.
Ronald R. Sederoff, Ph.D., North Carolina State University.
Anne R. Kapuscinski, Ph.D., University of Minnesota.
James Lauderdale, Ph.D., Upjohn Company.
William Witt, D.V.M., Ph.D., Food and Drug Administration.
Pamela G. Marrone, Ph.D., Entotech, Inc.
Susan Harlander, Ph.D., Land O'Lakes, Inc.
Deborah K. Letourneau, Ph.D., University of California.
David A. Andow, Ph.D., University of Minnesota.
Rudy Wodzinski, Ph.D., University of Central Florida.
Stanley Pierce, Ph.D., J.D., Retired, Rivkin, Radler, Bayh, Hart, and Kremer, Uniondale, New York.
Edward P. Bruggemann, Ph.D., Resigned, National Audubon Society.

United States Department of Agriculture, Agricultural Biotechnology Research Advisory Committee List of Meetings, 1990–1992

Fiscal Year 1990: January 10–12, 1990; February 27–28, 1990, Research Guidelines Working Group; April 23–24, 1990; and June 21–22, 1990.

Fiscal Year 1991: November 26, 1990; February 20–21, 1991; May 21, 1991, Classification/Confinement Working Group; and May 22–23, 1991.

Fiscal Year 1992: October 30–31, 1991, Classification/Confinement Working Group; December 2, 1991, Classification/Confinement Working Group; December 3–4, 1991; March 11–13, 1992; August 25, 1992, Risk Assessment Working Group; and August 26–27, 1992.

Fiscal Year 1993: October 15, 1992, Aquatic Biotechnology/Environmental Safety Working Group.

INSTITUTIONAL BIOSAFETY COMMITTEE

Mr. Durbin. You mentioned the Institutional Biosafety Committee. What is this committee, what is its function, and who are the members?

Dr. Jordan. The National Institutes of Health—NIH—assumed responsibility in the mid-1970s for overseeing the safety of laboratories conducting recombinant DNA research under containment. The NIH established the Recombinant DNA Advisory Committee—RAC—to work through a network of Institutional Biosafety Committees—IBC—at research institutions to provide on-site advice to the institution on safety concerns. There are today more than 400 IBC's nationwide. The NIH has issued guidelines for laboratory safety with recombinant DNA research and the IBC's provide local oversight and administration of these guidelines.

The membership of IBC's is prescribed by the NIH Recombinant DNA Guidelines. IBC's are to include appropriate institutional scientists, a representative of the community and a public health official. Many institutions augment IBC membership beyond the guideline requirements to better address certain technical areas of their particular institution, e.g. human medicine, agriculture. This augmentation is, of course, encouraged and is commonly done.

Mr. DURBIN. Does APHIS approve only field testing of bio-engineered plants or does it also have some permitting process related to animals?

Mr. MEDLEY. APHIS has regulations which could be used for the field testing of animals that have been modified by a viral gene. APHIS also has regulations which govern the importation and interstate movement of such animals. Under these regulations, APHIS would evaluate the risk of disease transmission to domestic animals caused by association with bioengineered animals bearing such a viral gene.

APHIS BIOTECHNOLOGY FUNDING

Mr. DURBIN. For the record please provide a table that shows the staffyears and annual funding for the past five years for biotechnology issues for APHIS.

[The information follows:]

ANIMAL AND PLANT HEALTH INSPECTION SERVICE ANNUAL FUNDING AND STAFF YEARS FOR BIOTECHNOLOGY, FY 1989-1993

[Dollars in thousands]

	FY 1989	FY 1990	FY 1991	FY 1992	FY 1993
Funding	$2,869	$3,157	$3,952	$4,900	$4,971
Staff Years	45	50	55	60	62

Note: The environmental component of the biotechnology line-item has not been included in this table.

APPLICATIONS FOR FIELD TESTING

Mr. DURBIN. Please provide a table that shows the annual number of applications for controlled field testing for plant biotechnology products submitted each year and how many permits were actually issued in each year.

[The information follows:]

ANIMAL AND PLANT HEALTH PROTECTION SERVICE—PLANT BIOTECHNOLOGY RELEASE PERMITS APPLICATIONS RECEIVED AND PERMITS ISSUED

[By fiscal year]

	Applications received	Permits issued
FY 1987	5	
FY 1988	16	20
FY 1989	32	28
FY 1990	46	51
FY 1991	91	83
FY 1992	164	145
FY 1993 (as of 4/15/93)	163	69

APHIS COORDINATION ON RISK ASSESSMENT

Mr. DURBIN. Mr. Medley, you say in your prepared statement that you work closely with the Biotechnology Risk Assessment Re-

search Grants Program established in the Farm Bill. Describe for us the input that APHIS has in the awarding of these grants.

Mr. MEDLEY. APHIS has provided considerable input to the administrators of the Biotechnology Risk Assessment Research Grants Program. These communications have largely dealt with the identification of program areas in which we believe that there are risk assessment issues that are relevant to regulatory decisions by our Agency. We have also provided comments on several drafts for the Federal Register notice announcing the program.

INTERNATIONAL BIOTECH REGULATION

Mr. DURBIN. Mr. Medley, you also talk quite a bit about other countries' coordination and information exchange related to biotechnology harmonization and regulations. Are there currently any countries that would ban genetically engineered plants or animals from their countries that were produced in the United States under their regulations?

Mr. MEDLEY. A significant number of countries, particularly in the developing world, do not presently have regulations to provide for regulatory oversight for genetically engineered plants or animals. Most industrial nations do have such regulations or an equivalent oversight structure. Not all, however, anchor such oversight in the same, science-based and risk-triggered manner as does the United States. The European Community (EC) has, for example, a process-based directive that applies to all member states. Problems with implementation are forcing the EC to rethink the policy. Denmark, for example, has national legislation that bans any introductions of genetically engineered organisms. The law provides for exceptions to this ban, however, which have been granted for the two proposals for release that have been brought forward in Denmark to date. Until this process is completed, however, significant potential remains for non-tariff trade barriers to U.S. biotechnology products. Our harmonization efforts are aimed at preventing or reducing such trade barriers.

Mr. DURBIN. Thank you.

Mr. Thornton.

SCREWWORM RESEARCH

Mr. THORNTON. Mr. Chairman, I do have a line of questioning I want to move to. But first I would like to compliment you for scheduling this very important hearing and also for your question concerning trying to get public perceptions misled by using words or slogans and trying to make it appear that money is being wasted. It seems to me that a few years ago there was a great deal of concern about research into the capacity of male screwworm flies to be sterile. And that that was a real pork type thing, was it not? We really wasted a lot of money on that. Would someone comment on that?

Dr. PLOWMAN. Well, I think some of the members of this Committee took a trip to Mexico just recently and maybe heard about the screwworm down there. We probably could not get all the money that the screwworm program has saved for this country as

well as our neighbors to the south through learning about the sex life of the screwworm fly.

Mr. THORNTON. In other words, a very modest investment resulted in billions of dollars of savings to American consumers.

Dr. PLOWMAN. Yes. Unfortunately, it takes a long time for the recognition to become appropriate. The two scientists responsible for that were awarded the World Food Prize this past year. We are kind of proud of that.

REGULATIONS

Mr. THORNTON. I would think you should be. I just hold that one example up, Mr. Chairman, as an example of how the people who raid the research barrel and claim that certain items are pork are dealing only, sir, with ignorance. They are not concerned with the facts or with the real benefits which may accrue—not in every instance. Sometimes there are scientific projects which do not yield harvests, but in many instances there are. And much of our society is based upon harnessing the inventive genius of the American researchers to the marketplace.

I want to thank each of you for testifying, but there is something that concerned me as I listened. I did not hear much talk about the crazy patchwork quilt of regulations. I think you are doing a super job of trying to make arcane and ancient rules fit and be flexible enough to meet today's standards. But would it not be useful to try and see if there could be some uniform standards? Some revision of some of our statutory laws might make it possible for you to focus more closely on your job, both in research and in regulation? Any comments on that?

Dr. JORDAN. One of the things that should make you feel good, Congressman, is that in organizing the mechanisms within the Department of Agriculture to bring the regulatory and research people together, we are talking about the same issue at the same time and we are talking about the regulations as they impact on researchers as well as how they impact on the agricultural community and the consuming public as well. Through that mechanism, the opportunity to drive our regulations on a strong science base has really taken hold across this nation and that goes across all the regulatory agencies. I would say EPA, FDA, and so on.

Mr. THORNTON. In some instances, however, the scientific community is ahead of the Congress, is it not?

Dr. JORDAN. May I defer that? [Laughter.]

Mr. THORNTON. I see Mike Taylor is sitting behind you, sir. He and I worked on the National Academy of Sciences project on pesticides and food. Our study recommended a uniform standard of negligible risk as the guideline to replace the cumbersome and ineffective results of the Delaney Clause applying to certain pesticides while others were grandfathered in. This is one example of the kind of anachronisms that you have to deal with. Does it make it more difficult for you to have to deal with these patchwork quilt type problems?

FOOD SAFETY

Dr. KESSLER. Congressman, we were able to develop the policy that we talked a little about within the existing framework.

Mr. THORNTON. I know. Congratulations for being able to do that. It was a little bit of magician work, I thought.

Dr. KESSLER. Respectfully, I am not sure I agree 100 percent with this patchwork quilt analogy when you look at the federal food provisions.

Mr. THORNTON. Okay.

Dr. KESSLER. I am not sure it was just simply a succession of Congresses oblivious to what the previous one did. I think that when you look at the Act and you look at the food safety provisions, I think that in some ways they provide such enormous flexibility to regulate circumstances that were never dreamed of at the time they were enacted. And that is in part what we are dealing with. The 1906 provisions, Section 402, the basic concept, you know, may render injurious. That applies to food biotech that was never envisioned at the time that the statute was enacted.

Yes, there may be certain tools, that may be appropriate for today that were not envisioned, but I am not ready to throw out the Act.

UNIFORMITY OF REGULATIONS

Mr. THORNTON. Well, I am not suggesting that that Act should be thrown out. In fact, I think it is one of the better drafted acts and does provide more flexibility than some that affect some other agencies such as EPA and others who are not present here.

I am concerned about different standards. You have worked very well within the organization of that Act and I commend you for it. But looking at it as an overall question, there are different standards that are applied by different agencies, are there not?

Dr. KESSLER. Yes, sir.

Mr. MEDLEY. Mr. Thornton, I would like to address that. I agree in terms of seeking common standards and uniformity of application. But I would like to say that I think that with regard to whether or not we should have different laws, I would like to agree with Dr. Kessler that when you look at the major statutes being used, whether it is the broad definition of plant pests or drugs or pesticides, it gives great latitude. The concern I have is not for uniform standards or uniform application, but rather taking an approach which looks at one all encompassing statute, because I think that type of approach does not allow for the individual industry application.

Mr. THORNTON. I would be pleased to yield to the chairman.

AGENCY JURISDICTION

Mr. DURBIN. If the gentleman from Arkansas would yield.

We understand a news report from Michigan suggests that a company there had produced a virus-resistant squash and because it is virus-resistant, it is technically considered to be a pesticide and that the EPA has to approve this variety rather than the FDA. I do not know if that news report is accurate, but it raises a question of jurisdiction here and whether or not at some point in the

process FDA must step in on a food safety question or the EPA jurisdiction on the so-called pesticide end. I think it is this overlapping that my colleague from Arkansas is alluding to.

Mr. THORNTON. Thank you, Mr. Chairman. I agree.

Mr. MEDLEY. Mr. Chairman, that is an excellent example. On that issue here talking about the virus-resistant squash, specifically whether or not the viral coat protein that has been added to that would fit within the definition of a pesticide. On December 18th of last year, the Environmental Protection Agency held a hearing where they did in fact give out a proposed policy that stated that although the viral coat protein could be technically defined as a pesticide, they could—based upon its use—also use their authority to exempt that particular application from coverage. So I would reiterate my belief that as we look at the issue of increased coordination among the agencies, we should be held accountable and address the exact concerns that you are raising.

Mr. THORNTON. Yes, sir, Mr. Jordan.

Dr. JORDAN. Congressman, I would like to bring to your attention the fact that there is a committee called the FCCSET Committee on Life Sciences and Health. There is very strong opinion that that is the place where these various functional agencies should get together to be sure that they do not step on each other's feet, get in each other's way and trip, and so forth. It is not perfect by any means or manner, but it is a very real effort——

Mr. THORNTON. Well, it is a means to address the problem that I was raising.

Dr. JORDAN. That is right. The President through Vice President Gore and through the science advisor to the President, Mr. Gibbons, is putting heavy emphasis to do exactly that. You bring an excellent point up with respect to the Delaney amendment, Congressman.

Mr. THORNTON. Yes.

Dr. JORDAN. I do not know of anything more debilitating to the United States of America than simply because you can measure something down lower, that it is no longer usable. The reasonable risk surely has to be assigned.

Mr. THORNTON. Absolute zero. Zero tolerance is a very difficult thing to deal with.

Let me swing this question towards something I would like to get your response on. Are we concentrating too much on assessing risks and trying to determine how to do our job to make sure that toxins and other things do not get into the food—I do not want to reduce that. I want to keep it up. But where is the vision for developing new standards of nutrition for higher quality food, for studying the effect of good nutrition on early childhood development—towards studying the effect on the aging process, of developments that, with the scientific knowledge that is represented here, we ought to be paying some attention to?

I thought, Dr. Kessler, your statement about enabling the Food and Drug Administration to make faster and more accurate methods to detect microbial pathogens in food, the E. coli and the vibrio cholerae was an example of such forward thinking. But is there something that you all can do to make us focus more on how to have a better quality of nutrition available for American citizens?

NUTRITION LABELING

Dr. KESSLER. Congressman, we have spent the last two years, even a little longer, on the new food label. It is starting to appear in the grocery store. I saw the first couple about a week or two ago in the bakery section of one of the local supermarkets. Wait until you see it. I mean it is even readable. You can actually see it. You do not need a magnifying glass.

Mr. THORNTON. That is a real breakthrough.

Dr. KESSLER. We hope so. I think that is a very important step with regard to the whole nutrition question.

Certainly those efforts, you know, will have an enormous payoff. But if we do not also assure public confidence in some of these other areas, perhaps the payoff is not as great in the end. Unless we assure the public confidence, I think that we are not going to benefit from what is on the horizon.

Mr. THORNTON. I could not agree with you more. I think that the assessment of risks is very important. I would like to suggest, however, that additional emphasis is needed on problems of nutrition—how to provide a better, safer product that can enable children to grow more healthy, and elderly people to age more slowly. I am very interested in that. [Laughter.]

Mr. THORNTON. Thank you, Mr. Chairman.

Mr. DURBIN. Thank you. Ms. DeLauro?

Ms. DELAURO. Thank you, Mr. Chairman.

Dr. Kessler, I wanted to ask a couple of questions about BST. There has been controversy over the issue and the hormone that is used for more efficiency in dairy production. What is the current status?

BOVINE SOMATOTROPIN (BST)

Dr. KESSLER. Bovine Somatotropin (BST) is a compound that is manufactured by several different companies. The application that was discussed about two or three weeks ago at a meeting of our Veterinary Medicine Advisory Committee was that of the Monsanto's BST version. Several years ago, the question of whether the milk prouced from BST cows was safe, was presented at an NIH technology assessment which conference concluded that the milk and meat from treated cows are safe for human consumption. The issue that was raised several weeks ago was whether the cows have an increased incidence of mastitis and, therefore, is there a potential that there can be an increase in the use of antibiotics and would that result in an increased antibiotic residue. The advisory committee's recommendation several weeks ago was, no. That basically the milk that has antibiotic residues gets discarded, gets thrown away. So even though there is an increase in mastitis that is associated with the BST, in the end it is a manageable risk and it has really a negligible effect because the milk gets discarded. So we looked at the safety. The advisory committee looked at the safety of the milk itself. There is an advisory committee that has looked at the mastitis issue.

Today in the Federal Register a notice will publish stating that in early May there will be a joint advisory committee of our Center

for Foods as well as our Center for Veterinary Medicine looking at the question of labeling for BST.

MILK RESEARCH

Ms. DeLauro. Let me ask kind of an underlying question about this issue. In the deliberations, has there been the question asked of whether or not in fact we need increased dairy production? Are we looking at this scientific experiment in the context of what we need in terms of increased efficiency in our milk production?

Dr. Kessler. Congresswoman, it is an excellent question. And as Congressman Thornton pointed out, you have given us an Act that we follow. And there are many issues that you have raised in that question that go beyond the jurisdiction of the Food and Drug Administration. We are a scientific agency. And the Act requires the agency to look at the safety of the product and requires us to make a determination with regard to whether labeling would be false or misleading in any particular.

That is what the agency looks at: safety of the product, and whether consumers would be misled if it were not appropriately labeled. That is what our jurisdiction is. We do not determine whether the product is good for this country, what it is going to do to the dairy price program, or whether the average taxpayer is going to end up paying more money. We do not ask who is going to benefit? Is this good for the farmer? Is this good for the consumer? Is this good for the public? Those questions, the economic questions on BST, are outside the boundaries of the Food and Drug Administration. They are important questions, but I think from our perspective, our expertise is on the science, and that is what we can contribute to the process.

Dr. Plowman. Could I respond to that?

Ms. DeLauro. Yes, certainly.

IMPACT OF TECHNOLOGY

Dr. Plowman. If you ask a hard cold question, you say do we need more milk, no. We can produce all the milk this country needs without that. But it needs more conversation than that.

Twenty-five years ago we had in this country about 25 million milk cows. And we were producing a little more than one billion pounds of milk. And today we have about 10 million milk cows and we produce 1.2 or 1.3 billion pounds of milk. A whole lot of things have contributed toward more efficient milk production. And I think that has been good for the country. It is the only way that we can still buy a gallon of milk for about what we did 10 years ago. Our farmers have to become more efficient. But when questions like that are raised it opens up other questions and you have to say, "Well, do we need any more wheat, corn, or soybeans?" You know, we do not need any more, right now. We can produce all we need without new technology. But should we? I think is the real question. Should we do that? Should we become more efficient in agriculture?

The only way that a farmer can stay in business, unless you are willing to pay at least as much for the product as inflation would indicate over the years, is to become more efficient. And farmers

are now getting about the same thing as they did in 1970 for their wheat and their barley and their oats and their corn. And so how do we keep farmers in business?

Well, they have new technology so they can be more efficient. So, there is the question about developing new technology for more efficiency and production. I do not have a good answer for that. I have a personal opinion that it has been good for this country to do that. It has provided us with cheap and abundant food. It has provided us for a great export market that has helped with our balance of trade and I think it has been good for us.

Ms. DeLauro. I think it is a philosophical question which could be debated I suppose ad nauseam. But the question is, quo vodus? What do we want to do? What is our end goal? And then how do we try to reach it? And that is not to say that we ought not be engaged in cutting-edge technology, but to what cost, to what end? And I do not believe that this is the case, but we ought not to be dealing without some sort of a framework, without some set of goals that we are trying to reach. I think then we do not let the goals drive the science, but going off in whatever directions we are going off in because of the sake of perhaps there is a good——

Dr. Plowman. Well, you are asking a real question about the biotech business of BST. And Dr. Kessler's responsibility is to ensure that it is a safe, healthy product. Now the research shows that you cannot detect, in the milk from a cow that has been treated with BST, any more of the hormone in a cow that has been treated artificially than one that has not been. And, so, there is no difference in the composition of the milk.

Now if you talk about efficiency, if a farmer can get the same amount of milk from 80 cows as he would from 100, that sounds good to me. That is a way he can stay in business. So he does not necessarily have to produce more milk, but he can get the same amount of milk from 80 cows as he would from 100. I think that is good. Having grown up on a dairy farm, I like that.

Ms. DeLauro. The question is what happens with the dairy price, there are other kinds of things that need to go into the configuration of what we are doing. I am not suggesting that our being efficient is not a goal and that is what we ought to be doing.

Dr. Plowman. The real question——

Ms. DeLauro. But there are other consequences which one ought to look at in terms of what directions we go in.

Dr. Plowman. This labeling question on BST is really an important one. If you cannot tell the difference in milk whether a cow was treated or not, then the fundamental question is why should you label it except some people think, "Well, you ought to. I have got a right to know what caused that milk." But you cannot tell from the milk. There is no way to tell the difference because there is not any difference. And so, I do not know, Dr. Kessler, I am going to be interested in how you resolve those kinds of things. [Laughter.]

Ms. DeLauro. You wanted to make a comment.

Dr. Jordan. Congresswoman, I would simply add that you are quite correct, that all the dimensions of the equation need to be considered. For example, in this case, if you can do the same amount of milk production with 80 cows as you can with 100, then

there is a big difference in the waste management problems and other things that come along with it so that there are a number of trade-offs. I would love to see us separate scientific inquiry from the ultimate application of that scientific knowledge. It is at that juncture that some of the things that are discovered by scientists do not seem to be economically feasible and they sit on the shelf until it becomes appropriate or maybe there are other regulations that prevent it from being appropriately used or inappropriately used, for that matter. There are other dimensions to it and you are quite right.

AQUACULTURE

Ms. DeLauro. I have another question for APHIS and for the FDA. The research into the possibility of looking at genetic engineering to enhance aquaculture by developing vaccines to prevent the spread of disease in cultured fish or in shellfish. Connecticut has a large shellfish industry and that is the reason why I ask. Are there any products that have been approved or are currently pending approval for aquaculture and then could we get a list of these products if that were the case.

Mr. Medley. In APHIS, we do have several vaccines for fish that have been licensed. I do not believe that any of the applications currently pending for biotech products are for aquaculture.

Ms. DeLauro. Thank you.

Dr. Kessler. There are no applications pending, Congresswoman, with the FDA.

BASIC AND APPLIED RESEARCH

Ms. DeLauro. If I might just ask a question of ARS and CSRS. This has to do with—well, with ARS you talked about $114 million on biotechnology research. How much is going into basic research versus applied research?

Dr. Plowman. Again, that is an extremely difficult question because it is difficult to draw the line between what you would call basic and applied. Very fundamental research in ARS is looking toward an applied problem. We do a lot of basic work, but we do it because that is the kind of science that we feel like we need to solve a problem. And, so, it is hard to say, this is the line and on this side it is basic research and on this side it is applied research because it is all working toward a solution of problems. So I hesitate, if you will press me, I will give you a figure, but it will be one that neither one of us could prove.

Ms. DeLauro. You are right. It is not so much the dollar amounts, but there is that debate in the area of human health and biotechnology, the debate within the discipline, if you will, of the importance of basic research and comparison to applied research. Is it your sense that we have a proper balance, that you would like some other different configurations?

Dr. Plowman. I think, there is usually a good reason why we are where we are at the present time. I think the balance is pretty good. I think, again, we do the kind of science that we need to so that we will have the tools to solve problems. Take the screwworm, if all we needed was a bigger fly bat to kill screwworms, we would

have just developed a new fly bat. But if you need to back up and understand the whole reproduction process of the screwworms, at that time you might have said, "Well, that is really basic work." And it was, but it was basic in relation to the kind of information we needed to solve this problem, but it was always going somewhere.

COMMERCIAL APPLICATION OF BIOTECHNOLOGY

Ms. DeLauro. My final question is one of the concerns that, particularly in biotechnology in the human health area, is that of the United States taking advantage of our advantage in basic research when it comes to converting this research into kind of practical applications, it is a little bit like what we do in our manufacturing sector. We have the ideas, they get produced, et cetera, but we do not commercialize that technology immediately into our manufacturing. Is it your concern in terms of agricultural biotechnology that that is a danger for us? What countries pose the greatest threat to us in terms of our being able to, if you will, commercially apply our agricultural technology?

Dr. Plowman. Well, many things have happened in just the last few years. Since the Technology Transfer Act was passed government agencies have a lot more of flexibility to work directly with commercial interests to further development and to pass on technology. We call them Cooperative Research and Development Agreements and that has been a very good tool. I think there is a whole lot more, at least my sense is that there is a whole lot more interest and awareness among scientists to get their information into use as fast as possible. It is a new kind of thinking for them. And in just these last two or three years I can see a great deal of difference in how people think about that. I think our relationships in working with private industry, too, have changed a whole lot in the last few years. We have signed more than 200 of these Cooperative Research and Development Agreements. And the word gets around and so everyone is looking for opportunities now that they did not have in the past. I think the situation is extremely healthy at the present time.

TECHNOLOGY

Ms. DeLauro. Are there countries that pose a threat to us?

Dr. Plowman. Well, we used to have a real corner on agriculture technology, but there are lot of good things going on in other countries now. France, Germany, Japan, are coming here to spend time in our laboratories and see what we do. We need to spend a little more time seeing what they are doing and maybe trade technologies. In the past we did not think we had to, but I do not think that is the case anymore.

Ms. DeLauro. Thank you very much.

Dr. Jordan. There are countries that are pushing us and I think are pushing us to, as Dr. Plowman indicated, closer relationships to industry than we thought were ethically appropriate in fairly recent times in all honesty. One of the things that has broken this wide open to a large extent has been something that the Congress put in that many of us in the scientific world really questioned at

the time, but I am going to come on the other side of the fence now and say, "Man, if you tried to stop it, I would really come apart at the seams myself." And that is the Small Business Innovation Research program.

There is a particular story that I have asked Dr. Arthur Kelman, our chief scientist, to relate to you. It will only take a second.

Dr. KELMAN. There is a close coordination. CSRS also has responsibility for the Small Business Innovation Research program and Dr. Charles Cleland who heads that gave me a report two days ago on a site visit which best exemplifies the way in which basic mission-linked research as described by Dr. Plowman is having a payoff. A company in the research triangle has developed a machine that automatically injects eggs with a vaccine which has tremendous implications for the poultry industry. I could provide you with the details, but I think that is the best example that I know of recently of this transfer of basic research in immunology into a definite innovative development that will have an impact on the poultry industry.

Ms. DELAURO. Thank you very much.

Thank you, Mr. Chairman.

Mr. DURBIN. Mr. Pastor?

Mr. PASTOR. Mr. Chairman, I am just going to take a few minutes. In my opinion, genetic engineering started about two centuries ago. There was a monk somewhere that worked on some flowers and developed hybrids. So it is nothing new. I think we have been at it for at least several centuries. I think, simply, all we have done is to take modern, biotechnological methods, which I think have been around at least 20 to 25 years, so it is nothing new. I think the application probably has caused us to have this hearing. I think it falls under the jurisdiction of the FDA. If people feel that there is enough scientific proof that the product, animal or plant, is safe to consume, I think people will generally take that as a positive sign, a stamp of approval and buy it and consume it.

The question I have is that I know that as you experiment with plants and animals, you are continuing to take in data to see whether or not it is a viable product and marketable. When does FDA, when do you make the decision that it is worthwhile to take it out beyond the experimental stage and proceed to the commercial area? And, when does FDA step in so that we have that stamp of approval that it is safe to consume and hopefully it will have a method of how to label it?

You know, to me this genetic engineering is something that has been going on for a long time. It is just that we are using new methods. And how do we get the stamp of approval of the final product so they can go out in the field and be consumed, or out in the market to be consumed?

Dr. KESSLER. Congressman, I think you are correct in many respects. I think what the public is concerned about, and I think we need to put it on the table, is that traditional genetic engineering, the kind that you are talking about, had certain boundaries. You could cross certain plants with certain plants, and get another plant, but there were limits to what those natural boundaries were.

The newer techniques have eliminated some of those boundaries, and I think what the public wants to make sure of is that those

boundaries, now that they are broken down, that there is as much assurance that the newer kinds of results will not present any untoward effects. So I think we do have the issue of assuring confidence, and it is absolutely critical.

EARLY CONSULTATION

The issue as far as when do we get involved—the answer is the earlier the better. What we have said in our food biotech policy is that it is absolutely essential for companies to come in early and have consultation with us, so that the road map toward marketing is clear in everyone's mind.

I think a person would have to be foolish to come up with a new biotech product without consulting with the agency. No one is going to buy it! People want that stamp of approval. Consultation is in fact the way the food industry and the agency work with regard to traditional new product innovations. So in many ways you are right; it is building on the past practices of early consultation, and setting out from the beginning the road map to getting the product to the market.

Mr. PASTOR. Is the problem that we are not having enough consultation as we are still in the experimental stage? What seems to be the problem?

Dr. KESSLER. No. With regard to the newer technologies, we do not have products yet that are there, that are marketed. We have set out the framework, and our experience is the consultation with the industry that has an interest in these products is excellent.

Mr. PASTOR. Well, let me take this peach tree as an example. We are now growing this peach tree, hopefully soon it will give us peaches. But at what point does Freddi come to say, look, I am doing this to the peach tree and the objective of the experiment is to not change the fruit, but to make sure that the leaves do not rot.

Now, does she start consulting with you now so that when the peach is finally available you have an understanding of what has been done experimentally and your people have been involved with her research so that you have a better idea of what modifications have been made to the actual fruit which is going to be consumed?

Dr. KESSLER. Let me let Mr. Taylor just talk a little about it, because the peach obviously has to do with a disease-resistant strain.

Mr. PASTOR. Right.

Dr. KESSLER. In that framework, you know, it needs to be explained.

Mr. TAYLOR. This relates to the question Mr. Thornton raised earlier about the jurisdictional issues that arise with respect to some of these technologies, and, in particular, whether a disease-resistance trait would be regulated as a pesticide by EPA or as an food substance by FDA.

The policy resolves that by providing that if you fall within the definition of pesticide, and most disease-resistant traits would do that, that product would be regulated by EPA. But this in a way raises the same basic question that the Commissioner has referred to and that you raise.

The important thing is for the commercial sponsor of that product well in advance of the time that that product is ready for com-

mercial marketing, while it is in the development stage, when they anticipate bringing the product forward, they need to be consulting with the responsible regulatory agency. The key hook as a practical matter is not likely to be the government researchers, but the proponent of the commercial marketing of the food, who in this case would likely need to go to EPA. But in the early stages of development, if there is a question about which of the agencies would have jurisdiction, that is the very purpose of early consultation. As the Commissioner said, so there can be a clear road map laid out early on to get to the point where it can be lawfully commercially marketed.

Mr. PASTOR. Well, let us say that the product development was in the peach itself, so it is FDA responsibility, a hypothetical, not in this particular tree, but let us take the work she is doing on the fruit itself, more pulp, more, you know, whatever, more sugar is in there.

Now, when would you get involved in the process so that you have a better understanding of what changes come about so that when, you know, they come to you and say you have an idea of what has been happening in the past, now your scientists get a hold of it and they, you know, will do experiments on it and determine the different contents so they can label it properly? When does this all start if it is an FDA jurisdiction.

Mr. TAYLOR. Well, again, as the Commissioner said, the prudent company would come in well ahead of the time when they had finished the development of the plant for commercial marketing. We are talking to companies now who are two and three years away from having a product that they would say is ready for commercial marketing. But they are coming in, they are consulting about the way in which they develop the plant, they are consulting about the kinds of evaluations they should do with respect to the safety questions that we have discussed. So what is happening now is that companies that are still years away from having commercially ready products are coming in to consult so that we can be sure collectively that we are doing the right safety tests, and asking and answering the right questions.

Mr. PASTOR. Well, let me ask a question. Do we have a problem if these companies, whether public or private, are coming in with enough time, do we have a problem in today's market with any of these fruits or animals that have been genetically engineered?

Mr. TAYLOR. One of the things that I think the public misses in this debate is that this policy development process, and this beginning process of consultation with the industry on new products under development is well ahead of the normal curve, the technology development curve. In the past, we have had lots of experiences where technologies get out into the marketplace before the regulatory framework is in place. We have a regulatory framework and a standard of care for evaluating the safety of these products that is in place well ahead of the first product being in the marketplace.

We do not have a commercially marketed product, so I think the answer to your question is, no, we do not have a problem. We are getting good experience with companies responding to the policy statement and coming in for early consultation. I think we are well ahead of the point where you could say we are having a problem

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for failure of companies to consult earlier, for failure to adequately deal with safety questions.

Dr. KESSLER. You know, this is just the reverse of the problem where something has gotten out that shouldn't have and we have to pull it back. Here, we have set out the rules before products are introduced, so that we will not have a problem with something getting out without our assurances, our stamp of approval.

Mr. PASTOR. So I guess what we need to do is to assure the American consumer that the regulatory body is in place, the engineering of genes in the biotechnology is in place and going forward, and that things that will have the stamp of approval by the FDA can be consumed safely.

Dr. KESSLER. That is correct.

Mr. PASTOR. So then we have to go out and teach our American consumers that everything is okay, and that the credibility is there.

Dr. KESSLER. That is correct.

Mr. PASTOR. Thank you, Mr. Chairman.

Mr. DURBIN. Thank you very much, Mr. Pastor, and I want to thank this panel. I have learned a lot this morning and I think the other members of the Subcommittee have as well. We will be watching this very closely because of the jurisdiction of this Subcommittee. I thank you all for your generous contribution of time and the information you have given us.

The Committee will stand adjourned.

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Food and Drug Administration
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Statement by

David A. Kessler, M.D.

Commissioner

Food and Drug Administration

Public Health Service

Department of Health and Human Services

Before the

Subcommittee on Agriculture, Rural Development,
FDA, and Related Agencies

Committee on Appropriations

House of Representatives

April 20, 1993

For Release Only Upon Delivery

Mr. Chairman:

The public is faced with what at times must seem like a bewildering assortment of new technologies. From pocket size computers to information super highways to the latest medical improvement, consumers face a dizzying array of new scientific advances that are often accompanied by an equally confusing litany of new terms.

In this type of environment, it is very important for people to understand exactly how government is overseeing these developments and have confidence in that process. That is why I want to commend you Mr. Chairman, for providing this opportunity to discuss one such extremely important new development -- food biotechnology.

FDA is working diligently to be at the forefront of this emerging field. We intend to ensure that these new products meet the same high safety standards as the foods we eat today. Unsafe food products are not going to make their way onto America's dining tables. Let me emphasize that. Unsafe food products are not going to make their way onto America's dining tables.

We have carefully developed a policy to accommodate the changing and evolving world of biotechnology. We know that there will continue to be new questions to answer and we intend to deal with each one in a careful, thoughtful way. We are committed to protecting the public, through a policy that will have their confidence and support.

I know that some are concerned and anxious about products developed through biotechnology, especially food products. But I believe there are many misconceptions about what bioengineered food products are and about how FDA intends to regulate them. Today, I will provide FDA's perspective on these issues and hopefully alleviate some consumer concerns.

First, let me explain what we are talking about when we use the terms "food biotechnology" or "genetically engineered foods." Many of the foods that are already common in our diet are obtained from new plant varieties using conventional genetic techniques of breeding and selection. We are all familiar with hybrid corn, nectarines, which are derived by genetically modifying peaches, and tangelos, which are a genetic hybrid of a tangerine and grapefruit.

Food products produced through biotechnology such as recombinant DNA techniques and cell fusion are emerging from research and development. It is these products that people normally refer to as "genetically engineered foods."

The new "gene splicing" techniques are being used to achieve many of the same goals and improvements that plant breeders have sought through conventional methods -- the techniques that bring us hybrid peas, and disease resistant wheat. Today's techniques are different from their predecessors in two significant ways: first, they can be used with greater <u>precision</u> and allow for more complete characterization and, therefore, greater predictability about the qualities of the new variety. These techniques give scientists the ability to isolate genes and to introduce new traits into foods without simultaneously introducing any of the undesirable effects that often accompany traditional breeding. This is an important improvement over traditional breeding.

Second, today's techniques give breeders the <u>power</u> to cross boundaries that could not be crossed by traditional breeding. For example, they enable the transfer of traits from bacteria or animals into plants. It is this power, the ability to cross natural boundaries, that many in the public are concerned about

when they hear about biotechnology. I understand this concern. That is why I disagree with those who say we need only concern ourselves with the final product and not the process that created it. While study of the final product ultimately holds the answer of whether or not a product is safe, knowing the process used to create the product helps in understanding what questions to ask. That is the way FDA currently regulates food products, and products derived through biotechnology will be treated no differently.

FDA POLICY STATEMENT

FDA published its "Statement of Policy: Foods Derived from New Plant Varieties," on May 29, 1992. The statement explained our views about regulating human foods and animal feeds produced from new plant varieties, including crops developed by the newest methods of molecular and cell biology (such as recombinant DNA methods and somaclonal variation) and those developed using traditional techniques. The policy applies to all new varieties of food crops, no matter which techniques are used to develop them. It focuses on the traits and characteristics of the foods.

Publication of the food biotechnology policy was FDA's response to numerous inquiries from industry, other government agencies, academia, and the public requesting clarification of the regulatory status of foods derived from new plant varieties developed using biotechnology techniques. The questions being asked are just what you might expect. Will FDA conduct premarket review of new foods? If genetically engineered foods are introduced into commerce without FDA approval, would FDA take enforcement action against them? Which new plant varieties might come under the jurisdiction of FDA? What scientific information may be necessary to satisfy FDA and the public that genetically engineered foods are safe and comply with the law? Will special labeling be required on genetically engineered foods?

FDA's policy was developed by our scientists through careful consideration of new developments in biotechnology in a step-wise process. We believe that it is essential to have a sound scientific basis for our policy. To ensure this, we have carefully followed the developments in research over the past several years to determine the types of commercial foods and food ingredients likely to be developed by recombinant DNA techniques. We also considered scientific principles for assessing safety

that had been developed and agreed upon by several prestigious scientific groups, including the National Academy of Sciences (NAS), the Food and Agriculture Organization (FAO), the World Health Organization (WHO), and the Organization of Economic Cooperation and Development (OECD), as a general starting point in developing our policy.

In reviewing new foods under development, we found certain common characteristics of plants developed by recombinant DNA techniques, such as the following: (1) Recombinant DNA techniques are being used to synthesize and introduce copies of <u>one or a limited number of</u> well-characterized genes into a desired food crop. The introduced gene or genes then become integrated in the plant and are passed to successive generations of plants by the natural laws of genetics. (2) In most cases, these genes produce proteins, or proteins that modify fatty acids or starches in the plant, in other words, common food substances. (3) The proteins, fatty acids, and carbohydrates introduced into food crops are well characterized and not known to be toxic (as could be the case for a pesticide). They would be digested to normal metabolites in the same manner that the body handles the thousands of different proteins, fatty acids, and starches that make up our diet today.

Since newly introduced substances in foods derived using recombinant DNA techniques would be proteins, fatty acids, and starches, we then examined the safety questions that should be addressed before products reach the market. We identified four broad safety issues that should be evaluated: (1) the need to ensure that new substances, that is, newly introduced proteins, fatty acids, or starches are safe for consumption; (2) the need to ensure that there are no unintended or unexpected changes in the food, such as an unacceptable level of a natural toxin; (3) the need to prevent unacceptable changes in important nutrients; and (4) the need to analyze the potential for introduced proteins to cause allergic reactions. We incorporated these and other issues into a comprehensive "guidance to industry" section that is central to our policy.

The guidance in our policy statement provides a "standard of care" to help plant developers ensure that the products they develop meet the safety standards of the Federal Food, Drug, and Cosmetic Act (FD&C Act). It also provides guidance to industry on those situations in which developers should consult with the FDA on issues such as labeling, design of appropriate test protocols, and whether a food additive petition would be required.

Our scientific guidance to industry is consistent with the general principles outlined in the various documents issued by the FAO/WHO, OECD, and NAS. However, to ensure a consensus within the scientific community at large, we published a lengthy article in Science magazine that describes the scientific underpinning of our policy. These principles have been well received by the academic and agricultural research community and are being considered by other agencies and governments.

ADEQUACY OF CURRENT FOOD LAW

As we have described in our policy, foods derived from new plant varieties are regulated by FDA under the existing framework of the FD&C Act. Our broad authority under current law, including the post market provisions, is sufficient to ensure the safety in the marketplace of foods derived from new plant varieties.

Two specific authorities of the FD&C Act help us to do our job effectively. First, FDA regulates food additives -- substances intentionally introduced into food, which are not generally recognized as safe (GRAS). The FD&C Act requires premarket approval of any food additive -- regardless of the technique used to introduce it. Thus, substances introduced into food are

either (1) new food additives that require premarket approval by FDA or (2) GRAS, and are exempt from the requirement for premarket review because, for example, there is a long history of safe use in food.

In developing our policy on foods derived from new plant varieties, we believed that a substance that would be a food additive if it were added during traditional food manufacture should also be treated as a food additive if it is introduced into food through genetic modification of a food crop. For example, a novel sweetener bioengineered into food would require premarket approval. Generally, under our policy, substances intentionally introduced into food that would be reviewed as food additives include those that have unusual chemical functions, known toxicity, or are new major dietary components of the food.

Based on our assessment of current developments in agriculture research, most substances intentionally added into food will be well characterized proteins, fats, and carbohydrates, and thus will not raise safety concerns that would require premarket approval. We believe, however, that our authority under the food additive provisions of the FD&C Act permits us to require

premarket approval of any intentionally introduced substance that raises a legitimate safety concern.

In addition, we have authority to remove a food from the market if it is deemed adulterated under the FD&C Act. Historically, this postmarket authority is the primary legal tool that FDA has relied upon to ensure the safety of whole foods. It is important to keep in mind the FD&C Act places a legal duty on food producers to ensure the safety of the foods that they market.

LABELING REQUIREMENTS

In their comments on our policy, many consumers have said that they have a "right to know" about the food they eat and requested that foods developed through genetic engineering bear special labeling. The FD&C Act, however, does not require that all information that may be of interest to consumers be disclosed on the label. The labeling provisions of the FD&C Act define -- and in effect limit -- the information that must be present on the label. For example, the law prohibits food labeling that is false or misleading. In part this means that information that is material to the representations about the product or material to consequences that may result from its use must be in the

product's labeling. The law also requires that a food product be described by its common or usual name, which must accurately describe the food, and reveal information with respect to ingredient labeling and nutritional content. In analyzing the labeling requirements for "genetically engineered" foods, FDA must determine what type of information falls within these legal requirements and thus may be required to appear in labeling or on the food label.

Labeling, by law, is limited to identifying significant changes in a food's composition, and it must not mislead consumers. Thus, for example, if a tomato had a peanut gene introduced into it, labeling would be needed to alert consumers to the presence of the potential allergen, unless it could be demonstrated scientifically that the peanut allergen was not present. Similarly, if a copy of a new gene introduced into a carrot produces a protein that significantly changes the carrot, the name "carrot" may no longer accurately describe the product and a new name would be required.

SPECIAL DIETARY CONCERNS

Comments in response to our policy statement raised possible implications for vegetarians, or others with special religious or ethical dietary practices, of eating plant foods that contain copies of genes derived from animals. It is important to point out that no animal material is actually transferred to the plant in such cases. When an animal gene is transferred to a plant using genetic engineering, scientists make copies of the animal gene in the laboratory, either by chemical synthesis or by introducing the gene into a microorganism that then replicates the gene. The chemically or microbially synthesized DNA fragment is introduced into the plant, which thereafter makes its own copies of the gene. Therefore, food from the plant contains a replica of a gene that is found in an animal, but does not contain animal material *per se*.

Currently, there are only a few examples of such food crops in the research and development stage of crop improvement. These crops may contain one or a few newly introduced copies of genes derived originally from animals, which become part of the plant's genetic information along with the thousands of genes already present in the plant's chromosomes. These newly introduced genes

will produce proteins that will be constituents of the food, although generally the protein will be present at very low levels in the food. Moreover, many cellular proteins differ very little in structure and function, even between very different organisms. For example, rice contains genes found in the human brain.

However, we are aware that these scientific explanations may not satisfy everyone, and this is an issue that we expect to address through further public dialogue on labeling.

Mr. Chairman, we are aware that consumers are very interested in, and concerned about labeling. We are also aware that these new techniques will likely raise novel labeling issues for the agency's consideration. We take these matters, and especially the consumer concerns about them, very seriously. We will look very carefully at these issues, and plan to take a number of steps in the near future to seek further public input on these subjects.

CURRENT FDA ACTIVITIES

One of the actions FDA took when we published our "Statement of Policy" was to request public comment. We wanted to be certain

that a broad segment of society -- including scientists, the food industry, and consumers -- had an opportunity to give us their views.

We currently are reviewing more than 3,300 letters (mainly from consumers) that were submitted. Three frequently raised issues concern: (1) labeling of foods derived from new plant varieties developed using "genetic engineering" techniques, (2) premarket notification, and (3) the potential allergenicity of foods derived from "genetically engineered" plants.

Mr. Chairman, let me announce today that FDA will shortly be publishing a Federal Register notice to request additional, specific information relating to consumer requests for special labeling for foods derived using "genetic engineering" techniques. The information requested in this notice will help the agency identify important issues that may be discussed at a future public meeting.

We will also be looking further at the question of premarket notification, which has been suggested by many comments, and which would address the interest many have in assuring that government possesses information about all applications of

recombinant DNA techniques in plants. As of this date, approximately a dozen firms have consulted with FDA to discuss safety testing for products which they expect to commercialize in the near future. In addition, several food ingredient enzymes produced using recombinant DNA techniques are under review through the petition process. We anticipate that many of these companies will voluntarily submit information to secure our agreement that they have followed our guidance. But we may need to do more thinking in this area, including about the extent of our current legal authority to require such notification.

Allergenicity of new foods is also a concern of the public, food developers, and the FDA. Because of the uncertainty related to whether specific newly expressed proteins in "genetically engineered" foods may cause allergic reactions, we also are exploring mechanisms to further engage the scientific community on the question of the potential allergenicity of foods derived from genetically engineered plants.

We also will address other issues as they are identified during our review of these comments.

We are also continuing discussions with the international community, particularly Canada and the European Community, to achieve harmonization of our regulatory processes.

BIOENGINEERED TOMATO

As you know Mr. Chairman, one bioengineered product that has generated public interest is a new tomato that is under development that its sponsors hope will provide consumers with a better tasting tomato in the months when vine ripened tomatoes aren't available. The sponsors have asked FDA for advice about the status of this product and safety of the kanamycin antibiotic resistant gene (kan-R) used in its development. The kan-R gene is used to produce a "marker" protein to help companies identify which plants have successfully incorporated a new, desired trait.

These questions were the first requests we have received about foods and components of foods derived from new plant varieties developed using recombinant DNA techniques. Recently, we received additional data and information from the sponsors that we are reviewing.

Research and commercial experience with recombinant DNA technology in pharmaceutical products have demonstrated the power and precision of this technology to modify genetic structure and function safely. However, there continues to be a great deal of consumer misunderstanding and concern about the use of recombinant DNA techniques, and the requests from the sponsors to review the safety of the kan-R gene and the status of this tomato derive at least in part from a desire on the part of that company to demonstrate to consumers that FDA agrees that foods derived using these techniques are acceptable for marketing.

Our decision about the regulatory status of this tomato will be announced in the Federal Register, so the public can be fully informed about the issues related to the review of this product.

FOOD BIOTECHNOLOGY RESEARCH

Recombinant DNA technology is also enabling FDA to make significant progress to produce faster, more accurate, and more practical methods to detect microbial pathogens in foods. Recent accomplishments include the development of polymerase chain reaction (PCR) methods for the rapid detection of Vibrio cholera (the organism that causes cholera) in food and for the rapid

detection of Hepatitis A virus, and the development of a gene probe for the detection of E.coli O157:H7. As you know, both of these food contaminants have been in the news in recent months -- Vibrio in molluscan shellfish and E.coli in hamburger. Better methods to detect these pathogens before they are consumed in food are urgently needed.

In addition, FDA's National Center for Food Safety and Technology is conducting research to develop biosensors to detect and measure microbial toxins and contaminants on-line during the manufacturing process. Our scientists also are studying microbial fermentations to determine the effects of variables such as available oxygen and pH on the formation of byproducts that may be a health concern in the final product.

CONCLUSION

Mr. Chairman, I want to reemphasize again how important it is for us to be able to explain to the public that we have a process in place, that they can have confidence in, that will ensure that food biotechnology products are safe. We will ensure that biotechnology derived foods meet the same high standard as today's food.

FDA's 1992 policy statement points out that premarket clearance is required if -- and this is a significant point -- we have any uncertainty about safety. The policy also makes clear -- and FDA fully intends -- that labeling will be required if the composition of the genetically modified food differs significantly from what is expected for that food, or if the genetically modified food contains potential allergens. Through our 1992 policy, we are providing guidance to industry on how to approach these matters and when to consult with FDA.

Mr. Chairman, we are confident that our approach is appropriate. We are determined to take the approach that allows us to ensure the safety of new food products and also does not prevent the use of safe, new biotechnology techniques that give manufacturers the ability to produce better products -- and provide consumers additional choices.

Thank you.

AGRICULTURAL RESEARCH SERVICE

Statement of Dr. R. Dean Plowman, Administrator, Agricultural Research Service, United States Department of Agriculture, before the Subcommittee on Agriculture, Rural Development, Food and Drug Administration, and Related Agencies.

Mr. Chairman, and members of the Committee, we in the Agricultural Research Service appreciate this opportunity to discuss biotechnology research and its benefits for our Nation's producers and consumers. I am accompanied today by five members of my staff who will provide additional information on specific issues referenced in the testimony. They are listed on your witness list, but I will identify them for the Committee when they speak.

I would like to emphasize at the outset that ARS shares this exciting work and responsibility in biotechnology with many other agencies -- CSRS, APHIS, and FDA -- and institutions, both within and outside the Department. Several of these agencies are here to participate in this hearing. Through our testimony today we want to demonstrate the coordination of our biotechnology programs and our complementary roles.

Also, ARS and other Federal agencies are working closely with industry in biotechnology research and we are striving to transfer new knowledge and technologies to the private sector for further development and commercialization. This is the delivery

mechanism of the benefits of biotechnology research to the public and consumers.

Through development of new biotechnologies that deal with contemporary concerns such as food safety, product quality, biological pest control, and veterinary medicine, biotechnology is being used to increase world markets for American agriculture, safeguard the environment, and foster rural development. All biotechnology-derived products have grown in worldwide sales from none in 1980 to an estimated $6 billion in 1992 and are projected to reach $50 billion by the year 2000.

We are excited that this rapid growth in biotechnology will help us achieve societal goals in the remainder of this decade and into the 21st century.

Biotechnology is not a research program unto itself, but is a component of nearly all of our research programs. It is a set of techniques that involves the use of living organisms, their tissues cells, or molecular structures, to effect biological, chemical, or physical changes which will produce improved plants, animals, and new products. We estimate in FY 1993 that $114 million of ARS resources is dedicated to this effort. Modern biotechnology creates unprecedented opportunities to modify agricultural commodities precisely in a manner undreamed of a generation ago. ARS biotechnology research involves an array of new and traditional scientific techniques or approaches.

Tissue Culture

Tissue culture involves the growth and propagation of an organism in a laboratory "glass" environment from single cells or small pieces of tissue. Tissue culture techniques enable mass production of near identical clones, which is particularly useful in breeding improved crop and horticultural plants. ARS scientists are also using the technology to develop reliable laboratory lines of insect cells. Such cell lines are useful for studying basic biological factors governing insect growth, metabolism and behavior and factory-like production of viruses that can be used as biocontrols.

Monoclonal Antibodies

Monoclonal antibody technology is used to produce large amounts of nearly identical antibodies, which can single out specific antigens -- chemical or microorganisms that stimulate antibody production. This technology is being used in several important kinds of projects, especially the detection of organisms that cause plant and animal diseases as well as developing new vaccines.

Other applications of monoclonal antibody techniques are the discovery, study, and enhancement of biocontrol agents, soil contaminant detection, and manipulation of plant bioregulation mechanisms.

DNA Probes

A living cell contains the molecules of DNA -- deoxyribonucleic acid -- which carry the code for proteins that determine an organism's form and biology. Pieces of DNA from a disease-causing organism can be used to search or probe the host organism's DNA. If DNA pieces from the disease-causing organism combine with like or similar DNA in the host organism, the infecting pathogen is located. ARS research using DNA probes has led to the development of more accurate diagnostic tests for certain animal diseases as well as for detecting viruses and viroids that cause plant diseases, such as potato spindle tuber disease. DNA probes are being used as diagnostic tools in many research projects in order to understand and eventually control biological processes in crop plants and farm animals as well as pests and diseases that affect them.

Recombinant DNA

Molecular biologists can insert desired DNA molecules into a living cell and that DNA can then duplicate or replicate itself. This process is called "recombinant DNA." If the inserted DNA is transferred through offspring, genetic transformation has occurred. Recombination occurs naturally: it is the key to genetic diversity. In the laboratory, a scientist can accelerate this process and precisely combine DNA with needed traits to the

genetic diversity. In the laboratory, a scientist can accelerate this process and precisely combine DNA with needed traits to the DNA of plant or animal cells.

Gene Mapping

Gene mapping of the human genome has already attained considerable visibility. A similar program is underway in the U.S. Department of Agriculture to map genes in crop and animal species with the focus on traits having economic importance. Significant progress is being made using this technology.

The USDA gene mapping program is designed to determine the location of agriculturally important genes which give scientists precise information needed to understand and improve an organism.

Gene Transfer

DNA and associated traits can be moved from one organism to another using gene-transfer techniques, once the gene has been found and described. The genes are expressed in resulting plants and animals and their offspring. These are often referred to as transgenic plants and animals. Only a fraction of the time is needed compared to the years required to introduce genetic improvements through traditional breeding programs.

In addition, ARS scientists are using gene-transfer technology to enhance the effectiveness of biological agents that help control pests of animals, crops, and stored fruit. The technology is also being used to improve the ability of certain food-processing organisms to reduce cholesterol levels in processed foods containing dairy ingredients. The techniques also have application to developing resistance in cereal grains to insects and diseases.

Significant Accomplishments

Significant accomplishments have been made by ARS scientists. Time allows me to give only a few examples:

- DNA probes have been developed by ARS scientists at Ames, Iowa, to detect specific and unique nucleic acid sequences in several important livestock pathogens, some of which are the causative agent of diseases including bovine viral diarrhea, pseudorabies, calicivirus infection, listerosis, campylobacterosis, arcobacterosis, bovine herpesvirus infection, and bovine retrovirus infection. These diseases cause severe economic losses to the $72 billion livestock industry.

- ARS scientists at the Plant Gene Expression Center at Albany, California, which is cooperating with the University of California, are able to control the ripening process in fruit such as tomatoes. This will enable industry to provide abundant supplies of fresh fruit and vegetables the year round, and save millions of dollars in refrigeration costs and spoilage losses.

- Monoclonal antibodies were used to develop a blood test that is 90 percent accurate in detecting trichinosis in pigs, a disease also affecting humans. The test minimizes the risk of the disease to humans and offers protection to the $4.6 billion U.S. swine industry.

- Gene mapping is being used to precisely locate agriculturally important genes in plants. The technology improves germplasm of soybeans, corn, and other crops to develop disease and pest resistance, improve productivity and yield new, desirable products from plant and animal commodities.

- Peach trees developed from small shoots raised by tissue culture techniques bore 10 times more fruit in the second year than conventional grafted trees which normally need 3 years to begin producing. Such a

sizeable second year crop increases the income of orchard growers.

ARS scientists at Beltsville, Maryland, and elsewhere are redesigning genes in soybeans, tomatoes, peaches, rice, potatoes, sugar beets, and other crops which could result in healthier plants, more economical farming, and more nutritious food on the table.

In summary, many benefits will continue to flow from biotechnology application in agriculture. The development of alternatives to the use of costly and environmentally unsafe chemical pesticides can be accelerated. Genetically engineered plants produced by the tools of biotechnology already exist that have increased pest resistance. Biotechnology also aids in early detection of diseases, allowing farmers a chance to control them before animal productivity or crop yields are decreased or before harmful toxins are produced. Monoclonal antibody techniques are being developed by ARS researchers to detect minute amounts of residues or contaminants in food. New, nutritious and more marketable food products and new industrial processes and nonfood products can be developed. Chemicals and polymers currently derived from petroleum could instead come from agricultural products. Current research is improving the conversion of plant products into industrial lubricants and fuels and finding new uses for oils, starch, and dairy products. Biotechnology can

also aid in the production of high-cost health care and cosmetic products. The research is aimed at genetically improving both the plants that make the starting materials and the microbes that ferment them into desired products.

There is potential for a high return to U.S. agriculture from agricultural research that can also improve America's economic growth, productivity, and competitiveness. It is essential that the U.S. extend its leadership in agriculture and biotechnology research and technology transfer.

Mr. Chairman, this concludes my prepared statement. I will be glad to answer any questions you may have.

Biographical Sketch
FREDDI HAMMERSCHLAG

Dr. Hammerschlag received her B.S. degree from Skidmore College in Saratoga Springs, New York. She received both her M.S. and Ph.D. degrees from the University of Maryland in College Park, Maryland.

Dr. Hammerschlag began her 23-year career with the Agricultural Research Service (ARS) in 1969. She currently serves as a research plant physiologist at the Beltsville Agricultural Research Center.

Dr. Hammerschlag Has authored or co-authored 96 publications, and presented 38 papers at national and international meetings. She has served as Associate Editor for the Phytopathology and HortScience journals, and is currently Associate Editor for the Journal of the American Society for Horticultural Science. Dr. Hammerschlag's research has appeared in The Washington Post, and the Washingtonian and Smithsonian magazines.

Biographical Sketch
K. DARWIN MURRELL

Dr. Murrell was born in 1940 in burley, Idaho. He received his Ph.D. in microbiology and public health from the University of North Carolina.

Dr. Murrell served in the Medical Service Corps of the U.S. Navy from 1966 to 1969. He has spent most of his career in food animal research. Recent management positions he has held include: Associate Area Director of the Beltsville Agricultural Research Center, and Director of ARS' Midwest Area in Peoria, Illinois. In 1992, Dr. Murrell became Director of the Beltsville Agricultural Research Center and the U.S. National Arboretum.

Biographical Sketch
HARLEY W. MOON

Dr. Moon grew up on a farm in Minnesota. He earned his D.V.M. and Ph.D. degrees from the University of Minnesota. In 1968, he began his career with the Agricultural Research Service (ARS) as a research scientist. Currently, Dr. Moon is the Director of ARS' National Animal Disease Center in Ames, Iowa.

Dr. Moon has also served on the faculties of the University of Minnesota, University of Saskatchewan (Canada), Ohio State University, and Iowa State University. He is past president of the American College of Veterinary Pathologists, and a member of the National Academy of Sciences.

Biographical Sketch
RANDY C. SHOEMAKER

Dr. Shoemaker received his B.S. and M.S. degrees from the University of Wisconsin, and his Ph.D. in Genetics from Iowa State University. In 1985, after two years of post-doctoral research at the University of Nebraska, Dr. Shoemaker joined the Agricultural Research Service (ARS) as a research geneticist at Iowa State University.

Dr. Shoemaker specializes in soybean genetics and has developed a detailed genetic map of soybean chromosomes. His research emphasis includes the mapping of genes effecting seed composition and disease resistance, and evaluating soybean genome organization and structure.

Dr. Shoemaker also organizes a biennial conference on soybean genetics and biology, and serves as an editor or associate editor of two scientific journals. He currently coordinates the development and implementation of a national soybean genetic database.

Biographical Sketch
GERALD G. STILL

Dr. Still was born in 1933 in Seattle, Washington. He earned his B.S. degree from Washington State University in 1959, and his M.S. and Ph.D. degrees in 1963 and 1965 from Oregon State University.

Dr. Still served in the U.S. Army from 1952 to 1955. He has worked with the Agricultural Research Service (ARS) since 1965, where he began his career as a research chemist at the Metabolism and Radiation Research Laboratory in Fargo, North Dakota. Other positions he has held include: staff scientists on ARS' National Program Staff in Beltsville, Maryland (1976-80); chief scientist for Plant and Entomological Sciences in the Office of the Secretary of Agriculture, Washington, D.C. (1980-82); and National Program Director for Plant Physiology and Biochemistry, Beltsville, Maryland (1982-84). Since 1984, Dr. Still has been Director of ARS' Plant Gene Expression Center in Albany, California.

COOPERATIVE STATE RESEARCH SERVICE

Statement of Dr. John Patrick Jordan, Administrator of the Cooperative State Research Service (CSRS) before the Subcommittee on Agriculture, Rural Development, Food and Drug Administration, and Related Agencies.

Mr. Chairman and members of the Subcommittee: I appreciate the opportunity to appear here today on behalf of the Cooperative State Research Service to describe the Agency's perspective on agricultural biotechnology research and education, and the applicability of this technology for meeting the challenges facing U.S. agriculture and the environment. Dr. Plowman has provided you with a definition of biotechnology.

The Cooperative State Research Service administers funding for research and higher education to partner academic institutions located throughout the country. The authority for funding these programs resides in legislation and includes formula based funds to State Agricultural Experiment Stations (primarily located at 1862 and 1890 Land Grant Universities), Schools of Forestry, and Colleges of Veterinary Medicine; competitive grants awarded nationally to support research in agricultural issue areas; and Special Research Grants targeted to regional and national agricultural problems.

Awards made by CSRS are based upon science quality merit considerations, and relevance to national program needs for selection decisions. Competitive grants awarded through the National Research Initiative (NRI) Competitive Grants Program are reviewed in a manner comparable to programs at the National Science Foundation and the National Institutes of Health.

INVESTMENTS IN BIOTECHNOLOGY RESEARCH

In fiscal year 1992, CSRS estimates that about $74.0 million was invested through the Agency in agricultural and environmental biotechnology in five areas;

- Improving scientific knowledge
- Providing new products and processes
- Increasing science capability
- Fostering safe research
- Coordinating activities

This investment represents 17.1 percent of the Agency's 1992 budget, and demonstrates our commitment to the application of biotechnology for agriculture and the environment. I would like to briefly describe these five areas, and characterize the ongoing activities that are conducted through our institutional partnerships.

IMPROVING SCIENTIFIC KNOWLEDGE

The National Research Initiative Competitive Grants Program allocated $38.2 million in fiscal year 1992 in support of biotechnology research in plants, animals, and microbes. A major part of this investment was for genomic mapping of plant and animal species to characterize the genetic structure, molecular sequence and genomic location of agriculturally important traits. This USDA genome effort is a collaborative program with the Agricultural Research Service. In plants, for example, once these traits are identified, plant breeders are provided with powerful tools to enhance progress in crop improvement, to speed the development of disease and insect resistant plants, to minimize use of pesticides and to improve approaches to biocontrol. This ongoing effort complements the human genome effort of the National Institutes of Health and the Department of Energy, but because of the uniqueness of plants with respect to ability to carry out functions like photosynthesis, a separate program is essential. NRI is also funding research in basic molecular biology to discover how genes express themselves, evolve and rearrange to provide superior progeny. Other research projects are looking for ways to move desirable genetic traits between organism groups and to enhance gene expression through altered molecular sequences.

Funding through the CSRS formula based programs, such as the Hatch Act, and Special Research Grants are complementary to the investigations supported by the NRI. For example, work is going on to map the barley genome for quantitative traits

(such as yield and malting quality) and to identify genetic probes that can be used to assist plant breeders in selecting superior cultivars. Another project is developing techniques to insert genes into plants which make them resistant to soil parasitic pests, and thus lessen the need for costly soil pesticides. Another project is exploring ways to make plants drought resistant.

CSRS assures the quality of the science conducted in these projects through institutional and agency peer review of proposals, and, at certain partner institutions, through external program reviews of research, conducted usually on a five year cycle.

PROVIDING NEW PRODUCTS AND PROCESSES

CSRS has made a major commitment to support research that will lead to commercial applications of scientific discoveries. This is particularly important with regard to biotechnology as it ensures that our public research investments will result in new products and processes to benefit U.S. consumers. Our technology transfer efforts focus on biotechnologies that will increase the value of harvested agricultural products, provide greater utility, and enhance product quality. Some examples are:

The development of bacterial strains with enhanced nitrogen fixing capabilities and enhanced ability with respect to efficiency of energy utilization. Many major crops require application of nitrogen fertilizers. Such applications are expensive and can

contaminate the water supply. The newly developed bacteria can increase soybean yield without the use of nitrogen fertilizers.

The development of a rapid technique for identifying genetic markers in the DNA contained in conifer seeds. By correlating the markers with tree characteristics such as rapid growth or wood strength, it will be possible to identify desirable maternal parents and facilitate breeding.

Genes which are responsible for increased litter number and increased growth of muscles in pigs have been identified and mapped. This could lead to the selection and breeding of leaner pigs and, therefore, leaner pork.

The development of a biodegradable plastic polymer from corn with commercial potential, and a process for the inexpensive production of several industrial feedstocks.

Work is also proceeding on a method for converting low-value crop residues into ethanol fuels that, we are told, could be sold for 90 cents per gallon.

In addition, a new NRI program in processing for value added initiated in 1992 is encouraging developments in bioprocessing.

INCREASING SCIENCE CAPABILITY

CSRS awards nearly $4 million in fellowships to universities so they may recruit and train students pursuing a graduate degree in the food and agricultural sciences. This program, known as the National Needs Graduate Fellowship Program, is administered by CSRS's Office of Higher Education Programs. Biotechnology was named one of the national needs areas when the program began. Since then, 205 biotechnology fellows have been recruited with 119 pursuing an education in plant biotechnology and 86 focusing on animal applications.

In the NRI, a portion of the funds are allocated in Agricultural Research Enhancement Awards and Strengthening Awards. Approximately 25 percent of the Strengthening Awards were in the area of biotechnology. The Enhancement Awards provided support for graduate students, post-doctoral fellows and new investigators.

FOSTERING SAFER RESEARCH

The Agency has National Environmental Policy Act obligations to assure that any of our funded projects will not damage the environment or threaten human health. In addition, CSRS assists other Federal agencies by ensuring that researchers supported with agency funds comply with Federal regulations. To better meet these obligations,

and foster the beneficial applications of biotechnology to agriculture and the environment, CSRS established the National Biological Impact Assessment Program (NBIAP). NBIAP is supported by a Special Research Grant and it draws upon the unique networking strengths of the Department of Agriculture-Land Grant University partnership to involve the scientific community in advancing the safe development of the products of agricultural biotechnology. NBIAP activities are designed to facilitate safe field testing of genetically modified organisms. NBIAP provides to the scientific community an electronic bulletin board and database system that currently has 6,000 users who are given access to biotechnology and biosafety information via phone lines linked to a central computer at Virginia Polytechnic Institute and State University. The electronic bulletin board features a news report on biotechnology developments and an E-mail service, and serves as a gateway to databases with information on Federal regulatory requirements for field testing; State level contacts regarding biotechnology regulations; contacts for Institutional Biosafety Committee members; records of field test locations; current literature in biotechnology supplied by the National Agricultural Library; recently awarded biotechnology patents; and similar resources.

NBIAP has also developed and released an artificial intelligence-mediated computer program that assists the researcher in designing a safe field experiment and drafting an application for a Federal permit to conduct the field test. Version 3.0 was recently distributed to over 500 researchers with no copyright limitation, and with

encouragement to distribute the software to colleagues. This should foster safer research design and compliance with Federal biotechnology regulations.

A new NBIAP database presently under development will bring together Federal Environmental Assessments of field tests with genetically modified organisms into a sophisticated database that scientists, regulators, and policy-makers can use for more informed, science-based decisions about the benefits and potential risks of applying biotechnology to agriculture. This is an enormous undertaking, with thousands of pages of text being electronically compressed on to one Compact Disk - Read Only Memory (CD-ROM), to be matched to sophisticated software for rapid retrieval of information by word searches, indices, topical categories and other strategies.

To support research institution-based biosafety oversight, NBIAP will sponsor in 1993 a number of regional workshops for institutional biosafety officers and chairs of Institutional Biosafety Committees. The workshops will cover information on Federal biosafety obligations; principles of risk assessment; successful management practices (e.g. recordkeeping); support services available from Federal agencies; and resources that can be used for enhanced biosafety assurance.

NBIAP has also selected the University of California-Davis for a pilot program to develop instructional materials for classroom instruction on biotechnology principles.

The target audience for the first phase is grade school children. Phase 2 will focus on adult education materials.

Finally, the Cooperative State Research Service is co-sponsoring, with the USDA's Agricultural Research Service and the USDA's Forest Service, a Biotechnology Risk Assessment Research Grants program that was stipulated in the Food, Agriculture, Conservation, and Trade Act of 1990, Section 1668. This provision requires the Department to set aside one percent of its biotechnology research outlays to provide a risk assessment research grants program for biotechnology. The program annually solicits proposals from the U.S. scientific community in areas identified as priority needs by regulatory and research agencies. A peer review panel of scientists makes recommendations on the quality of the proposed projects, and on the relevance of the project to Federal regulatory needs. In 1992, its first year, the program awarded $1.4 million for eight research projects covering plants, animals, and microbes. We anticipate that $1.7 million will be available for awards in fiscal year 1993.

COORDINATING ACTIVITIES

This Committee will be interested to know about some of the mechanisms that the Department of Agriculture uses to coordinate its biotechnology activities. In 1986 the Office of Agricultural Biotechnology (OAB) was established to support the coordination needs of the Department and specifically its research agencies. The OAB also collects

information from both USDA and non-USDA agencies supporting agricultural biotechnology research for the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), biotechnology research initiative budget crosscut. The crosscut activity is organized by the Biotechnology Research Subcommittee (BRS) of the FCCSET Committee on Life Sciences and Health. This initiative has attempted to analyze Federal investment in biotechnology research across Departmental lines. USDA's total biotechnology research investment in FY 1992 at both Federal laboratories and academic institutions was $210 million. Added to this is $163 million of non-Federal funds at the academic institutions.

In 1986, the Department established a policy-level Committee on Biotechnology in Agriculture (CBA) composed of the administrators of six USDA agencies with significant biotechnology programs. The CBA is co-chaired by the Assistant Secretary for Science and Education and the Assistant Secretary for Marketing and Inspection Services. A subcommittee of the CBA, called the Biotechnology Council, is composed of senior staff from six USDA agencies. This council meets monthly to develop recommendations on biotechnology policy issues.

One of the highest priority issues for USDA has been to ensure that biotechnology research is conducted safely without adverse effects on the environment or human health. To aid in this effort, the Department formed an external committee of individuals from academia, industry, and government to provide expert advice on

biotechnology research issues. The Agricultural Biotechnology Research Advisory Committee (ABRAC) consists of 15 members with expertise in animal, plant, and microbial sciences; ecology and environmental policy; food science and technology; laws and regulations; and philosophy and bioethics. ABRAC serves a dual purpose - to solicit expert advice and to listen to public opinion.

USDA has recently developed a consumer information and education plan. The objective is to provide the general public with accurate, objective information on the science, potential uses, benefits to society, possible risks, and regulatory safeguards of agricultural biotechnology. Implementation steps for the plan are currently being developed by an interagency group of communication specialists.

The OAB prepares "Biotechnology Notes", a monthly publication that now reaches through the electronic media one-half million potential readers worldwide.

CONCLUSIONS

The Cooperative State Research Service's commitment to biotechnology research, education and safety has been significant. CSRS and university biotechnology activities stretch from fundamental research to more applied, pre-commercial applications. We are deeply committed to ensuring that public funds are being used to meet national and regional needs in agriculture and the environment by providing

high quality, safe biotechnology research; research that will support American agriculture, lead to a better quality of life for the American people and strengthen an economically competitive nation.

DAVID R. MACKENZIE

David MacKenzie is Director of USDA's National Biological Impact Assessment Program. This program facilitates the safe field testing of genetically modified organisms. Dr. MacKenzie is also Principal Plant Scientist in the Plant and Animal Sciences Division of the Cooperative State Research Service, USDA.

Currently, he co-chairs USDA's Advisory Committee on Plant Genomic Mapping, and serves on the National Association of State Universities and Land Grant Colleges's Committee on Biotechnology.

He also serves as consultant to the World Bank and the U.N.'s Food and Agriculture Organization on crop protection research.

From 1983 to 1989 he was head of the Department of Plant Pathology and Crop Physiology at Louisiana State University, and prior to that he was a plant breeder and plant pathologist at his alma mater, Pennsylvania State University.

DR. ALVIN L. YOUNG

Dr. Alvin L. Young is Director of the U.S. Department of Agriculture's (USDA) Office of Agricultural Biotechnology (OAB) and Science Advisor to the Secretary of Agriculture. The OAB coordinates biotechnology programs throughout 11 USDA agencies and initiates cooperative activities with representatives from academic institutions and the biotechnology industry, as well as with policy leaders of the European Community and the Pacific Rim nations. In addition to directing activities of the office, Dr. Young also serves as Executive Secretariat of the Agricultural Biotechnology Research Advisory Committee.

Dr. Young's career spans various research, academic, policy, and advisory positions with six Federal agencies and with the National Academy of Sciences. Prior to joining USDA, he was assigned to the Office of Science and Technology Policy, Executive Office of the President, as the Senior Policy Analyst for Life Sciences.

Dr. Young has conducted extensive research on the environmental, toxicological, and human health effects of pesticides for the Department of Defense. At the Veterans Administration, he served as Director of Research for Environmental Issues. He was Associate Professor of Biological Sciences at the U.S. Air Force Academy.

Dr. Young has authored many scientific books and articles on environmental issues, risk assessment, science policy, and biotechnology. He is Chairman of the White House Committee on Interagency Radiation Research and Policy Coordination and has been Chairman since its inception in 1984. He strongly supports the transfer of technology from the public to the private sector.

A native of Laramie, Wyoming, Dr. Young received his Bachelor of Science degree in Agricultural Sciences from the University of Wyoming, as well as a Master's of Science in Agronomy. He earned his Ph.D. in Herbicide Physiology from Kansas State University.

ANIMAL AND PLANT HEALTH INSPECTION SERVICE

Statement of Mr. Terry L. Medley, J.D., Acting Associate Administrator, Animal and Plant Health Inspection Service, before the House Subcommittee on Agriculture, Rural Development, Food and Drug Administration, and Related Agencies.

Mr. Chairman and members of the Committee, I am very pleased to be here today on behalf of Dr. Lonnie King, the Acting Administrator of the Animal and Plant Health Inspection Service (APHIS), to discuss APHIS' role in regulating agricultural biotechnology. In addition to serving as Acting Associate Administrator, I am the Director of Biotechnology, Biologics, and Environmental Protection, the organizational program within APHIS charged with biotechnology oversight.

APHIS' mission is to safeguard American agriculture by providing leadership in protecting the health of animals and plants as well as the improvement of agricultural productivity and competitiveness. Our mission also requires protection of the environment, since one cannot adequately protect agriculture without considering the environment as a whole. Consistent with this mission I will provide an overview of our activities for the oversight of veterinary biologics, plants, and other organisms developed through biotechnology. I will also describe our activities with respect to biotechnology coordination with other Federal agencies, and internationally.

PROTECTING ANIMAL HEALTH

In the area of animal health, the Virus-Serum-Toxin Act (VSTA) of 1913, as amended, provides APHIS with the authority to regulate all veterinary biologics that are imported into the United States, shipped or delivered for shipment interstate, intrastate, and that are exported. APHIS issues U.S. Veterinary Biological Product Licenses after satisfactory completion of all requirements to assure purity, safety, potency, and efficacy. Veterinary biological products produced by recombinant methods are evaluated on a case-by-case basis using the same stringent standards employed for licensing as for conventionally produced biologics.

APHIS has developed a three-category classification scheme for recombinant-derived products. That classification scheme, which is based on biological characteristics and safety concerns, was published in the Federal Register on June 26, 1986, as part of the final USDA policy statement on biotechnology (51 FR 23339, June 26, 1986).

APHIS has issued (57) licenses for veterinary biological products manufactured from biotechnological processes. Fifty are from category one products (products used prophylactically, therapeutically, or as components of diagnostic kits). One example of a category one product is a diagnostic test kit for Johnes disease, known as bovine paratuberculosis. The product has shortened the time for a diagnosis from two weeks to two days through use of a gene probe. Seven licenses have been issued for category two products, which contain live microorganisms that have been modified by the addition or deletion of one or more genes. All are for recombinant-derived pseudorabies virus vaccines for use in swine. The category one companion test kits for these products allow a veterinarian to distinguish between animals that have been vaccinated versus those that have been infected. This ability to distinguish between animals is very significant in disease control and eradication programs. No category three, live-vectored products, have been

licensed to date. However, APHIS has authorized field testing during the last 3 years in Virginia, Pennsylvania, and New Jersey of a live vaccinia vectored virus rabies vaccine for oral immunization of raccoons. Because of the spread of rabies in the Northeast, we are receiving inquiries from other States seeking to conduct field testing and wanting to know when this product may be licensed. During the coming year we expect to receive additional requests to field test other category three products. The field testing or licensing of these products is done in accordance with the National Environmental Policy Act.

PROTECTING PLANT HEALTH

Our regulations in Title 7, Code of Federal Regulations, Part 340, for certain genetically engineered plants and microorganisms, were promulgated under the authority of the Plant Quarantine Act and the Federal Plant Pest Act. Under these regulations we issue permits for the introduction (importation, interstate movement, and release into the environment) of certain genetically engineered plants and microorganisms. We regulate genetically engineered plants and microorganisms which meet our definition of "regulated article" because of the inclusion of genetic material from a plant pest source. These regulations, which became effective in July 1987, were the first final rules issued under the Federal "Coordinated Framework for the Regulation of Biotechnology" specifically designed to regulate the movement and release of genetically engineered organisms. The regulations are an extension of our regulations for conventional plant pests.

Since our regulations became effective almost 6 years ago, we have issued in excess of 370 permits for controlled field tests at over 724 sites in 35 States and Puerto Rico, and over 1,000 permits for movement. For each of the environmental release permits issued, we have prepared thorough environmental assessments. We would like to submit for the record a complete list of environmental release permits issued. We would note that the United States

leads the world in the number of authorized releases of genetically engineered organisms.

We seek the improvement of productivity and competitiveness by being an effective bridge for technology transfer. This can be accomplished in part by a regulatory framework which removes regulatory uncertainty and establishes appropriate regulatory requirements. Under such a framework the billions of dollars of spent in biotechnology research in the public and private sectors should ultimately result in new alternatives for agricultural producers and improved products for consumers.

PUBLIC ACCEPTANCE THROUGH PUBLIC PARTICIPATION

Participation is essential to public acceptance of biotechnology. APHIS acts to inform the public of permit applications it has received through the publication of notices of receipt and subsequently when a permit has been issued, a notice of availability of an environmental assessment. The regulations have mandatory provisions for State notification and review, and State requirements are incorporated as supplemental permit conditions. These procedures have served as a significant instrument for Federal/State cooperation. An August 1992 Office of Technology Assessment report entitled, A New Technological Era for American Agriculture, strongly endorsed the APHIS approach of seeking input from State regulatory personnel in preparing a science-based risk assessment.

MAINTAINING A CONTINUING DIALOGUE WITH STATE COOPERATORS

As a means of maintaining and enhancing communication and cooperation with our State cooperators, APHIS has taken the lead in sponsoring three national conferences on Federal and State regulation of biotechnology. In 1992, APHIS presented a briefing to the National Plant Board (the national board for State regulatory officials) on the status of Federal regulations for transgenic plants. We are continuing to conduct briefings for the members of regional

plant boards and plan another briefing of the National Plant Board again this summer.

ADJUSTING REGULATORY OVERSIGHT BASED ON EXPERIENCE

When APHIS issued its regulations in 1987, the Agency pledged to amend its biotechnology regulations "to keep pace with the scientific state of the art." In keeping this pledge, APHIS made amendments to its regulations in 1988 and 1990 to adjust restrictions on interstate movement of plants and microorganisms under conditions that would ensure biological and physical containment.

On March 31, 1993, APHIS published a final rule amending the regulations pertaining to the introduction of certain genetically engineered organisms and products. The amendments supplement the existing permitting requirements by adding two alternatives for the introduction of certain genetically engineered plants with which APHIS has had considerable experience. The alternatives are (1) a provision for notification of the introduction of certain regulated articles in accordance with eligibility criteria and performance standards, and (2) a petition for the determination of nonregulated status. The notification and petition amendments will become effective April 30, 1993. These amendments are based upon 5-1/2 years of Agency experience in issuing over 370 permits for the field testing of transgenic plants, and they are a logical evolution of the regulations. The rules were published in final form after consideration of comments, which generally favored an experience-based adjustment of regulation for some transgenic plants.

Under the notification provisions, an applicant must notify APHIS 10 days before interstate movement and 30 days before importation or release. In turn, APHIS will provide this information to the respective State regulatory officials for review and input. APHIS will then notify the applicant as to whether the movement or release can proceed under notification. Regulated

articles not appropriate for introduction under notification would continue to require a permit for introduction. Under the petition provisions, an applicant must submit, in accordance with APHIS requirements, all relevant information and data necessary to support a determination that the transgenic plant should no longer be regulated under the regulations in 7 CFR part 340. This includes any information known to the petitioner which is unfavorable to the petition. APHIS then has 180 days in which to approve or deny the petition. During this 180-day period, APHIS will publish notice in the Federal Register of the petition request and provide for a mandatory 60-day public comment period.

INTERACTION WITH OTHER USDA AGENCIES

Dr. Jordan has previously discussed the intra Departmental mechanisms for biotechnology policy coordination. I would like to briefly explain the basis for APHIS interactions with two other USDA agencies related to biotechnology regulatory issues. In 1985, responsibility for coordinating biotechnology regulatory policy within the Department and acting as a liaison with public and private organizations on all matters and functions relating to agricultural biotechnology regulatory matters was delegated to the Administrator of APHIS (50 FR 29367-68). In this regard, we have worked very closely with the Technology Transfer and Coordination Staff of the Food Safety and Inspection Service in their development of a regulatory policy for transgenic animals. We have also been working closely with the Biotechnology Risk Assessment Research Grants Programs established under the Farm Bill of 1990. We expect that the research funded through this program will prove to be useful in making future regulatory decisions.

COOPERATIVE WORKING RELATIONSHIPS WITH EPA AND FDA

As early as August 1987, EPA and APHIS exchanged letters agreeing that our agencies would collaborate in reviewing applications for field tests where jurisdiction is shared. Agency officials have regularly forwarded to EPA any

permit applications for field testing plants with any added traits that could be considered to meet the definition of "pesticide" in the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

During the last several years, in anticipation of commercialization of the first genetically engineered crop plants, APHIS and the FDA have been meeting on a regular basis to update respective staffs and exchange information which each agency finds mutually valuable. FDA has sought to rely on APHIS' environmental analyses, and APHIS has looked to FDA to resolve any food safety issues for plants that producers petition to remove from regulation. This feeling of mutual reliance has produced a very cooperative and congenial working relationship between the respective agencies' personnel. We are exploring the possibility of formalizing these consultative processes with EPA and FDA via memoranda of understanding as a means of assuring the public of the close coordination and cooperation that exists between the three agencies.

INTERNATIONAL

Internationally, our activities are aimed toward regulatory harmony, that is, assuring that regulatory processes among our trading partners are compatible. To this end we have pursued three objectives: (1) consistency and compatibility of national approaches, (2) coordination of those national approaches, and (3) utilization of science-based principles for evaluation of organisms. We have participated in numerous international activities as departmental or Agency representatives, or as part of a U.S. Government delegation to (1) international organizations, such as the Inter-American Institute for Cooperation in Agriculture, the Organisation for Economic Co-operation and Development, the Office Internationale des Epizooties, and United Nations agencies (FAO, UNEP, UNIDO); and (2) bilateral discussions with governments of trading partners such as Canada, Mexico, Japan, and the European Community.

In the Western Hemisphere, our activities have included close coordination and information exchanges with Agriculture Canada and Sanidad Vegetal of Mexico to promote international harmonization of regulations. Many countries, including India, Japan, Israel and several Central and South American countries, have either adopted or are considering adoption of provisions from our final rule for use in their own regulatory programs. Germany has indicated particular interest in our system and our notification proposal is getting much attention abroad.

CONCLUSION

In closing, I would like to note that our fiscal year 1992 expenditures for biotechnology was $4.9 million, which represents approximately 1 percent of the APHIS budget. These dollars assure protection of American agriculture and should allow the development of significant products for the benefit of the agricultural producers and consumers. That concludes my prepared remarks, Mr. Chairman. We would be happy to respond to any questions you may have.

BIOGRAPHICAL SKETCH

TERRY L. MEDLEY

Mr. Terry L. Medley is the Director of the Biotechnology, Biologics, and Environmental Protection (BBEP) unit. In addition, he has served since February 5, 1993, as Acting Associate Administrator of APHIS. As Director of the BBEP unit, Mr. Medley oversees and directs the activities of the National Monitoring and Residue Analysis Laboratory; Biotechnology Coordination and Technical Assistance; Veterinary Biologics; Veterinary Biologics Field Office; Biotechnology Permits; Environmental Analysis and Documentation; and the Technology Support Staff. These staffs are responsible for coordinating biotechnology regulatory activities within USDA and acting as liaison between USDA and other Federal agencies on matters pertaining to biotechnology regulation; issuing permits for genetically engineered organisms; regulating and licensing veterinary biological products; providing internal policies and procedures for pesticide registration; conducting chemical analysis for pesticide residues; and ensuring that APHIS programs comply with the applicable environmental laws. Previously, he served as the Director for the Biotechnology and Environmental Coordination Staff of APHIS. He was born in Union, South Carolina, on September 12, 1951. Mr. Medley graduated cum laude from Amherst College in 1974. He earned a Doctor of Jurisprudence degree from the University of Virginia School of Law in 1977, and was elected to the Raven Society for his scholastic achievement and service to the community. Mr. Medley is a member of the Virginia Bar Association.

Upon graduation from law school, he began his Federal career as an Attorney for the Regulatory Division of USDA's Office of the General Counsel. In 1982, he was promoted to Senior Attorney and advisor for APHIS' Plant Protection and Quarantine programs. As part of the coordinated Federal effort to regulate biotechnology, he assisted in the drafting of the Federal "Coordinated Framework for Regulation of Biotechnology." He was an author of the USDA regulations for genetically engineered organisms that may be plant pests. He is Vice Chair of the USDA Biotechnology Council, APHIS' liaison to the Agricultural Biotechnology Research Advisory Committee, and a member of the National Keystone Advisory Board for Biotechnology. He currently represents the USDA's Marketing and Inspection Services at the Organization for Economic Cooperation and Development meetings of national experts on safety in biotechnology. He is the principal advisor and alternate to the Assistant Secretary for Marketing and Inspection Services at the Federal Biotechnology Research Subcommittee. He is also Chairman, Biotechnology Ad Hoc Committee, North American Plant Protection Organization and Agency Environmental Compliance Coordinator.

He is a frequent speaker-participant at biotechnology and environmental conferences in the United States and abroad and his papers have been published in numerous proceedings. He has received the USDA's Award for Superior Service from the Secretary of Agriculture for Outstanding Leadership in the Development and Implementation of Biotechnology Regulatory Policy on Behalf of APHIS and USDA; the USDA's Federal Women Interagency Boards' Achievement Award for Outstanding Contributions to the Federal Women's Program and the USDA Office of Advocacy and Enterprise Partnership Award. Mr. Medley currently resides in Arlington, Virginia, with his wife Gerre and their two children.

DR. DAVID A. ESPESETH

Dr. David A. Espeseth is the Deputy Director of Veterinary Biologics, Biotechnology, Biologics, and Environmental Protection, Animal and Plant Health Inspection Service, U.S. Department of Agriculture. He is responsible for the development of licensing requirements and program policy for USDA's veterinary biologics program. This program assures the purity, safety, potency, and efficacy of veterinary biological products prior to shipment in or from the United States. This includes the review of applications for importation or licensure of all biotechnology derived vaccines, bacterins, diagnostics, etc., for veterinary use.

Dr. Espeseth is a member of the Council of the International Association of Biological Standardization and of the editorial board of "Biologicals." He serves on the Biologics and Biotechnology Committees of the United States Animal Health Association, as a consultant to the American Veterinary Medical Association's Council on Biologic and Therapeutic Agents, and as the APHIS representative to the International Technical Consultation on Veterinary Drug Registration. He has also served as the chairman of an Office of International Epizootics Consultation of Experts concerning the conduct of field trials of live biotechnology derived vaccines in foreign countries.

Dr. Espeseth received his B.S. degree in 1962 and his D.V.M. degree in 1964 from the University of Minnesota. Upon graduation, he spent 2 years in the U.S. Army Veterinary Corps at Fort Detrick, Maryland, and entered the Federal Service with the Veterinary Biologics Division, Veterinary Biologics Laboratories, APHIS, USDA, in July 1966. He was selected for a position on the Biologica Licensing and Standards Staff in Hyattsville, Maryland, in February 1968 where he worked until 1980. He attended the University of Maryland and, in 1971, was awarded his Master's degree in microbiology.

DR. JAMES L. WHITE

Dr. James L. White is the Acting Deputy Director of Biotechnology Permits and the Chief of the Plants Branch, Biotechnology, Biologics, and Environmental Protection, Animal and Plant Health Inspection Service, U.S. Department of Agriculture. Biotechnology Permits evaluates requests for the field testing and movement of genetically engineered plants and microorganisms that are developed using genetic material from known plant pathogens (regulated articles). Biotechnology Permits prepares a detailed environmental assessment of the potential impact of the regulated article on the environment in accordance with the National Environmental Policy Act and conducts inspections of release sites.

Dr. White is currently on the editorial board of "Microbial Releases," an international journal publishing scientific articles about release of genetically engineered organisms into the environment. He is also advisor to the American Phytopathology Society Virology Committee on the use of exotic plant viruses for research purposes.

Dr. White received his Bachelor's and Master's degrees in science from Florida Atlantic University. He received his Doctorate of Philosophy degree from the Department of Botany and Plant Pathology, Michigan State University. As a research scientist, he was employed at the University of California, Riverside; University of Nebraska, Lincoln; University of Hawaii, Honolulu; and, most recently, at the University of Maryland at College Park.

Dr. White's research has dealt with understanding the physiological and molecular interaction of plant pathogens (viruses and bacteria) and their host plants. He has authored over a dozen scientific publications.

federal register

Friday
May 29, 1992

Part IX

Department of Health and Human Services

Food and Drug Administration

Statement of Policy: Foods Derived From New Plant Varieties; Notice

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Food and Drug Administration

[Docket No. 92N–0139]

Statement of Policy: Foods Derived From New Plant Varieties

AGENCY: Food and Drug Administration, HHS.

ACTION: Notice.

SUMMARY: The Food and Drug Administration (FDA) is issuing a policy statement on foods derived from new plant varieties, including plants developed by recombinant deoxyribonucleic acid (DNA) techniques. This policy statement is a clarification of FDA's interpretation of the Federal Food, Drug, and Cosmetic Act (the act), with respect to new technologies to produce foods, and reflects FDA's current judgment based on new plant varieties now under development in agricultural research. This action is being taken to ensure that relevant scientific, safety, and regulatory issues are resolved prior to the introduction of such products into the marketplace.

DATES: Written comments by August 27, 1992.

ADDRESSES: Submit written comments to the Dockets Management Branch (HFA–305), Food and Drug Administration, rm. 1–23, 12420 Parklawn Dr., Rockville, MD 20857.

FOR FURTHER INFORMATION CONTACT: Regarding Human Food Issues: James H. Maryanski, Center for Food Safety and Applied Nutrition (HFF–300), Food and Drug Administration, 200 C St. SW., Washington, DC 20204, 202–485–3617. Regarding Animal Feed Issues: William D. Price, Center for Veterinary Medicine (HFV–221), Food and Drug Administration, 7500 Standish Pl., Rockville, MD 20855, 301–295–8724.

SUPPLEMENTARY INFORMATION:

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I. Background and Overview of Policy

New methods of genetically modifying plants are being used to develop new varieties that will be sources of foods. These methods, including recombinant DNA techniques and cell fusion techniques, enable developers to make genetic modifications in plants, including some modifications that would not be possible with traditional plant breeding methods. This policy discusses the safety and regulatory status of foods derived from new plant varieties, including plants developed by the newer methods of genetic modification.

FDA has received numerous inquiries from industry, government agencies, academia, and the public requesting clarification of the regulatory status of foods, such as fruits, vegetables, grains and their byproducts, derived from new plant varieties developed using recombinant DNA techniques. The questions that FDA has received center on issues such as whether the agency will conduct premarket review of these new foods, whether such foods introduced into interstate commerce would be challenged by FDA on legal grounds, which new plant varieties might come under the jurisdiction of FDA, what scientific information may be necessary to satisfy FDA that such foods are safe and comply with the law, whether petitions would be required by the agency, and whether special labeling would be required.

Representatives of the food biotechnology industry have expressed to FDA the need for strong but appropriate oversight by Federal agencies to ensure public confidence in foods produced by the new techniques. FDA has received several specific comments and suggestions from the industry and from the public concerning Federal oversight of foods developed through new methods of genetically modifying plants (Refs. 1 through 4). The agency has considered these and other documents, including scientific research papers, in developing this notice, and is setting forth this policy statement to clarify its interpretation of the act with respect to human foods and animal feeds [1] derived from new plant varieties, [2] including but not limited to plants developed by new methods of genetic modification.[3]

Under this policy, foods, such as fruits, vegetables, grains, and their byproducts, derived from plant varieties developed by the new methods of genetic modification are regulated within the existing framework of the act, FDA's implementing regulations, and current practice, utilizing an approach identical in principle to that applied to foods developed by traditional plant breeding. The regulatory status of a food, irrespective of the method by which it is developed, is dependent upon objective characteristics of the food and the intended use of the food (or its components). The method by which food is produced or developed may in some cases help to understand the safety or nutritional characteristics of the finished food. However, the key factors in reviewing safety concerns should be the characteristics of the food product,

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[1] "Food" means (1) Articles used for food or drink for man or other animals, (2) chewing gum, and (3) articles used for components of any such article (section 201(f) of the act (21 U.S.C. 321(f))). "Food" includes human food, substances migrating to food from food-contact articles, pet food, and animal feed (21 CFR 170.3(m)). "Animal feed" means "an article which is intended for use for food for animals or other than man and which is intended for use as a substantial source of nutrients in the diet of the animal, and is not limited to a mixture intended to be the sole ration of the animal" (section 201(x) of the act (21 U.S.C. 321(x)).

[2] "Variety" is used here as a general term to describe subgroups (whether varieties or cultivars) of plants within a species developed for desirable traits.

[3] "Genetic modification" means the alteration of the genotype of a plant using any technique, new or traditional. "Modification" is used in a broad context to mean the alteration in the composition of food that results from adding, deleting, or changing hereditary traits, irrespective of the method. Modifications may be minor, such as a single mutation that affects one gene, or major alterations of genetic material that affect many genes. Most, if not all, cultivated food crops have been genetically modified.

rather than the fact that the new methods are used.

The safety of a food is regulated primarily under FDA's postmarket authority of section 402(a)(1) of the act (21 U.S.C. 342(a)(1)). Unintended occurrences of unsafe levels of toxicants in food are regulated under this section. Substances that are expected to become components of food as result of genetic modification of a plant and whose composition is such or has been altered such that the substance is not generally recognized as safe (GRAS) or otherwise exempt are subject to regulation as "food additives" under section 409 of the act (21 U.S.C. 348). Under the act, substances that are food additives may be used in food only in accordance with an authorizing regulation.

In most cases, the substances expected to become components of food as a result of genetic modification of a plant will be the same as or substantially similar to substances commonly found in food, such as proteins, fats and oils, and carbohydrates. As discussed in more detail in section V.C., FDA has determined that such substances should be subject to regulation under section 409 of the act in those cases when the objective characteristics of the substance raise questions of safety sufficient to warrant formal premarket review and approval by FDA. The objective characteristics that will trigger regulation of substances as food additives are described in the guidance section of this notice (section VII.).

The guidance section also describes scientific considerations that are important in evaluating the safety and nutritional value of foods for consumption by humans or animals, regardless of whether the food is regulated under section 402(a)(1) or section 409 of the act. The guidance section outlines a "decision tree" approach to safety assessment of foods derived from new plant varieties that FDA believes is compatible with current practice among scientists knowledgeable in this area. The guidance section also identifies certain scientific questions that may raise sufficient safety concern to warrant consultation with FDA.

Finally, this notice addresses FDA's responsibility under the National Environmental Policy Act (NEPA) and the food labeling provisions of the act as such provisions affect labeling of foods derived from new plant varieties.

This policy statement reflects FDA's current judgment based on the new plant varieties now under development in agricultural research. FDA invites comments on this document. Because scientific developments in this field are occurring rapidly, FDA will refine its policy, if circumstances warrant, in a future Federal Register notice. Additionally, FDA plans to announce in a future Federal Register notice a workshop to discuss specific scientific issues. FDA invites comment on topics that might be addressed at such a workshop.

II. Responsibility for Food Safety

FDA is the primary Federal agency responsible for ensuring the safety of commerical food and food additives, except meat and poultry products. FDA works closely on food safety matters with the U.S. Department of Agriculture (USDA), which regulates meat and poultry products, and with the U.S. Environmental Protection Agency (EPA), which regulates pesticides and sets tolerances for pesticide residues in food. FDA's authority is under the act, the Public Health Service Act, and FDA's implementing regulations codified in title 21 of the CFR. The act gives FDA broad authority to initiate legal action against a food that is adulterated or misbranded within the meaning of the act.

Producers of new foods have an obligation under the act to ensure that the foods they offer consumers are safe and in compliance with applicable legal requirements. Because in some cases the regulatory jurisdiction of a new food product including those produced using innovative methods may not be clear, producers can informally consult with FDA prior to marketing new foods to ensure that the safety and regulatory status of a new food is properly resolved.

Elsewhere in this issue of the Federal Register, FDA announces the filing of the first request by a producer for consultation with FDA concerning a new plant variety developed by recombinant DNA techniques. The request submitted by Calgene, Inc., (Calgene) concerns the FLAVR SAVR™ tomato, a new variety claimed to exhibit improved fruit ripening and other properties. Because Calgene made this request prior to the finalization of this policy statement, FDA advised the firm to submit the information about the tomato initially as a request for advisory opinion under § 10.85 (21 CFR 10.85) to permit the agency to consider the status of the new variety, and to utilize an evaluation process that is open to public comment and permits the agency to make its decision known to the public. Future requests for FDA consultation should be made consistent with the principles outlined in this notice. Thus, FDA does not anticipate that future requests of this nature will be filed under § 10.85

III. Scope of This Document

This notice discusses scientific and regulatory considerations for foods derived from new plant varieties. This notice does not address foods and food ingredients regulated by FDA that have been derived from algae, microorganisms, and other nonplant organisms, including: (1) Foods produced by fermentation, where microorganisms are essential components of the food (e.g., yogurt and single cell protein); (2) food ingredients produced by fermentation, such as many enzymes, flavors, amino acids, sweeteners, thickeners, antioxidants, preservatives, colors, and other substances; (3) substances produced by new plant varieties whose purpose is to color food, and (4) foods derived from animals that are subject to FDA's authority, including seafood. FDA is considering whether to address these issues in future Federal Register notices.

Finally, the principles discussed in this notice do not apply to "new drugs" as defined by section 201 (p) of the act (21 U.S.C. 321(p)), "new animal drugs" as defined by section 201(w) of the act (21 U.S.C. 321(w)), or to "pesticide chemicals" as defined by section 201(q) of the act. As discussed in section IX., EPA is responsible for pesticide chemicals, including those produced in plants as a result to genetic modification.

IV. Scientific Issues Relevant to Public Health

Plant breeding is the science of combining desirable genetic traits into a variety that can be used in agriculture. The desired traits can be broadly divided into two classes: Those that affect agronomic characteristics of the plant, and those that affect quality characteristics of the food. Agronomic characteristics include those affecting yield; resistance to diseases, insects, and herbicides; and ability to thrive under various adverse environmental conditions. Quality characteristics include those affecting processing, preservation, nutrition, and flavor.

The genetic modification techniques used to develop new plant varieties constitute a continuum. Traditional breeding typically consists of hybridization between varieties of the same species and screening for progeny with desired characteristics. Such hybridizations only can introduce traits found in close relatives. Breeders have developed or adopted a number of techniques to expand the range of

genetic variation available to them. These techniques introduce variation either by using mutagenesis to alter the genome or by introducing or modifying DNA segments, including DNA segments derived from other organisms.

Mutagenic techniques include both random mutagenesis, resulting from treatment with chemical and physical mutagens, and somaclonal variation, whereby, with the use of tissue culture techniques, plants are regenerated from callus or leaf tissue explants. The regenerated plants often have properties not found in the progenitor plant, reflecting both preexisting cellular genetic differences and tissue-culture induced mutations. The mutations range from single gene changes to chromosomal rearrangements. Mutagenesis techniques are limited, however, by their inability to target a desired trait. Somaclonal variants also frequently are unstable or infertile.

Techniques for gene transfer between plants that belong to different species or genera fall under the general heading of "wide crosses." These "crosses" have been accomplished using hybridization, and protoplast fusion. Traditional wide crosses involve hybridization between closely related species or genera, frequently requiring the use of special techniques such as embryo rescue and chromosome doubling to overcome physical or genetic barriers to the production of fertile progeny. They permit the transfer of genetic traits that are not present in close relatives of the modern plant varieties but are found in more distant wild relatives. Traits that confer resistance to a number of diseases have been introduced this way.

All of the techniques described above require extensive back crossing with the parent line [4] to eliminate mutations unlinked to that responsible for the desired phenotype and undesirable traits in extraneous genetic material introduced along with that encoding the desired trait.

Recombinant DNA techniques involve the isolation and subsequent introduction of discrete DNA segments containing the gene(s) of interest into recipient (host) plants. The DNA segments can come from any organism (microbial, animal, or plant). In theory, essentially any trait whose gene has been identified can be introduced into virtually any plant, and can be introduced without extraneous unwanted genetic material. Since these techniques are more precise, they increase the potential for safe, better-characterized, and more predictable foods.

DNA segments introduced using the new techniques insert semi-randomly into the chromosome, frequently in tandem multiple copies, and sometimes in more than one site on the chromosome. Both the number of copies of the gene and its location in the chromosome can affect its level of expression, as well as the expression of other genes in the plant. To ensure homozygosity and to enhance the stability of the line and the ability to cross the trait into other lines, the breeder will often perform a limited number of back crosses to ensure that the plant line has the new trait inserted in only one location in the chromosome.

Additionally, as with other breeding techniques, the phenotypic effects of a new trait may not always be completely predictable in the new genetic background of the host. Therefore, it is common practice for breeders using recombinant DNA techniques to cross the new trait into a number of hosts to find the best genetic background for expression of the new trait. Currently, for most crops only a few lines or varieties of any species are amendable to the use of recombinant DNA techniques. Once the desired trait is introduced into a line amenable to the technique, it must then be crossed by traditional means to other desired lines or varieties.

Regardless of the particular combination of techniques used, the development of a new plant variety typically will require many site-years (number of sites x number of years of plant testing) of performance trials before introduction into agricultural practice. These range from as few as 10 to 20 site-years for some plants to 75 to 100 site-years for others (some 5 to 10 years). The time of evaluation and the size and number of sites will vary as necessary to confirm performance; to reveal vulnerabilities to pests, diseases, or other production hazards; to evaluate stability of the phenotype; to evaluate characteristics of the food; to evaluate environmental effects; and to produce the required amount of seed before the new plant variety can be grown commercially by farmers. In the course of this intensive assessment, individual plants exhibiting undesirable traits are eliminated.

Recombinant DNA techniques are used to achieve the same types of goals as traditional techniques: The development of new plant varieties with enhanced agronomic and quality characteristics. Currently, over 30 different agricultural crops developed using recombinant DNA techniques are in field trials. Food crops have been developed using these techniques to exhibit improved resistance to pests and disease and to chemical herbicides. For example, a plant's ability to resist insect infestation reportedly has been improved by transferring bacterial genetic material that encodes proteins toxic to certain insects (e.g., *Bacillus thuringiensis delta* endotoxin). Other plants have been given viral coat-protein genes that confer cross-protection to viral pathogens.

Other new plant varieties have been developed that exhibit traits for improved food processing, improved nutritional content, or enhanced protection against adverse weather conditions. For example, genetic modifications of plant enzymes involved in fruit ripening may yield tomatoes with improved ripening characteristics, texture, and flavor. Scientists have used recombinant DNA techniques to transfer genetic material for the production of seed storage protein conferring improvements in nutritional balance of important amino acids in the new plant varieties. Scientists have also identified genes in certain fish that encode proteins that conferee increased resistance to cold. Copies of these genes have been introduced into agricultural crops with the goal of producing new plant varieties that show improved tolerance to cold weather conditions.

These examples illustrate only a few of the many improved agronomic and food processing traits currently being introduced into plants using recombinant DNA techniques. Any genetic modification technique has the potential to alter the composition of food in a manner relevant to food safety, although, based on experience, the likelihood of a safety hazard is typically very low. The following paragraphs describe some potential changes in composition that may require evaluation to assure food safety.

A. Unexpected Effects

Virtually all breeding techniques have potential to create unexpected (including pleiotropic [5] effects. For example, mutations unrelated to the desired modification may be induced; undesirable traits may be introduced along with the desired traits; newly introduced DNA may physically insert into a transcriptionally active site on the chromosome, and may thereby inactivate a host gene or alter control of

[4] A line is a group of individuals from a common ancestry. It is a more narrowly defined group than a variety. (Breeding Field Crops, J.M. Poehlman, Van Nostrand Reinhold, New York, 1987.

[5] Pleiotropic effects refer to multiple effects resulting from a single genetic change.

its expression; the introduced gene product or a metabolic product affected by the genetic change may interact with other cellular products to produce a deleterious effect. Plant breeders using well established practices have successfully identified and eliminated plants that exhibit unexpected, adverse traits prior to commercial use.

B. Known Toxicants

Plants are known to produce naturally a number of toxicants and antinutritional factors, such as protease inhibitors, hemolytic agents, and neurotoxins, which often serve the plant as natural defense compounds against pests or pathogens. For example, most cereals contain protease inhibitors, which can diminish the nutritive value of proteins. Many legumes contain relatively high levels of lectins and cyanogenic glycosides. Lectins, if not destroyed by cooking or removed by soaking, can cause severe nausea, vomiting, and diarrhea. Cyanogenic glycosides can be hydrolyzed by specific enzymes in the plant to release cyanide if food from the plant is improperly prepared. The levels of cyanogenic glycosides in cassava and some legumes can lead to death or chronic neurological disease if these foods are eaten uncooked. Cruciferae contain glucosinolates which may impair thyroid function. Squash and cucumber contain cucurbiticin, an acute toxicant. Chickpeas contain lathyrogens, which are neurotoxins.

Many of these toxicants are present in today's foods at levels that do not cause acuate toxicity. Others, such as in cassava and some legumes, are high enough to cause severe illness or death if the foods are not properly prepared. FDA seek to assure that new plant varieties do not have significantly higher levels of toxicants than present in other edible varieties of the same species.

Plants, like other organisms, have metabolic pathways that no longer function due to mutations that occurred during evolution. Products or intermediates of some such pathways may include toxicants. In rare cases, such silent pathways may be activated by mutations, chromosomal rearrangements, or new regulatory regions introduced during breeding, and toxicants hitherto not associated with a plant species may thereby be produced. Similarly, toxicants ordinarily produced at low levels in a plant may be produced at high levels in a new variety as a result of such occurrences. The likelihood of activation of quiescent pathways or increased expression from active pathways is considered extremely low in food plants with a long history of use that have never exhibited production of unknown or unexpected toxins, since the genetic changes that can lead to such events occur during growth and are induced with traditional breeding manipulations. In the few cases where toxicants have been raised to unsafe levels in a commercial plant variety, the toxicants were known to occur in significant levels in one of the parent species. Except in rare cases, plant breeders using well established practices have successfully identified and eliminated plants that express unacceptably high levels of toxicants prior to commercial use.

C. Nutrients

Another unintended consequence of genetic modification of the plant may be a significant alteration in levels of important nutrients. In addition, changes in bioavailability of a nutrient due to changes in form of the nutrient or the presence of increased levels of other constituents that affect absorption or metabolism of nutrients must be considered for potential nutritional impact.

D. New Substances

Because plant breeders using the new techniques are able to introduce essentially any trait or substance whose molecular genetic identity is known into virtually any plant, it is possible to introduce a protein that differs significantly in structure or function, or to modify a carbohydrate, fat or oil, such that it differs significantly in composition from such substances currently found in food.

E. Allergenicity

All food allergens are proteins. However, only a small fraction of the thousands of proteins in the diet have been found to be food allergens. FDA's principal concern regarding allergencity is that proteins transferred from one food source to another, as is possible with recombinant DNA and protoplast fusion techniques, might confer on food from the host plant the allergenic properties of food from the donor plant. Thus, for example, the introduction of a gene that encodes a peanut allergen into corn might make that variety of corn newly allergenic to people ordinarily allergic to peanuts.

Examples of foods that commonly cause an allergenic response are milk, eggs, fish, crustacea, molluscs, tree nuts, wheat, and legumes (particularly peanuts and soybeans). The sensitive population is ordinarily able to identify and avoid the offending food. However, if the allergen were moved into a variety of a plant species that never before produced that allergen, the susceptible population would not know to avoid food from that variety.

In some foods that commonly cause an allergic response, the particular protein(s) responsible for allergenicity is known, and therefore the producer may know whether the transferred protein is the allergen. However, in other cases, the protein responsible for a food's allergenicity is not known, and FDA considers it prudent practice for the producer initially to assume that the transferred protein is the allergen. Appropriate in vitro or in vivo allergenicity testing may reveal whether food from the new variety elicits an allergenic response in the potentially sensitive population (i.e., people sensitive to the food in which the protein is ordinarily found). Producers of such foods should discuss allergenicity testing protocol requirements with the agency. Labeling of foods newly containing a known or suspect allergen may be needed to inform consumers of such potential.

A separate issue is whether any new protein in food has the potential to be allergenic to a segment of the population. At this time, FDA is unaware of any practical method of predict or assess the potential for new proteins in food to induce allergenicity and requests comments on this issue.

F. Antibiotic Resistance Selectable Markers

In gene transfer experiments, only a small percentage of the recipient plant cells will actually take up the introduced genes, and many desirable traits (i.e., those that specify the intended technical effect) are not easy to detect before the plant has fully developed. Scientists, therefore, enhance their ability to isolate plant cells that have taken up and stably incorporated the desired genes by physically linking the desired gene to a selectable marker gene, such as a gene that specifies the production of a substance that inactivates antibiotics.

The kanamycin resistance gene is one of the most widely used selectable marker genes. The kanamycin resistance gene specifies the information for the production of the enzyme, aminoglycoside 3'-phosphotransferase II. The common name for this enzyme is kanamycin (or neomycin) phosphotransferase II. The kanamycin phosphotransferase II enzyme modifies aminoglycoside antibiotics, including kanamycin, neomycin, and geneticin (G418), chemically inactivating the antibiotic and rendering the cells that produce the kanamycin resistance gene product refractory or resistant to the

antibiotic. Plant cells that have received and stably express the kanamycin resistance gene survive and replicate on laboratory media in the presence of the antibiotic, kanamycin. Plant cells that did not take up and express the introduced kanamycin resistance gene will be killed by the antibiotic. By linking the selectable marker gene to another gene that specifies a desired trait, scientists can identify and select plants that have taken up and express the desired genes.

The kanamycin resistance gene has been used as a selectable marker in more than 30 crops to develop varieties that exhibit improved nutritional and processing properties, resistance to pests and diseases, tolerance to chemical herbicides, and other agronomic properties. Once the desired plant variety has been selected, the kanamycin resistance gene serves no further useful purpose, although it continues to produce the kanamycin phosphotransferase II enzyme in the plant tissues. Thus, while the kanamycin resistance gene is a research tool that is important for developing new plant varieties through the current recombinant DNA techniques of gene transfer, both the kanamycin resistance gene and its product, the kanamycin phosphotransferase II enzyme protein, are expected to be present in foods derived from such plants, unless removed through recently developed techniques (Ref. 5).

Selectable marker genes that produce enzymes that inactivate clinically useful antibiotics theoretically may reduce the therapeutic efficacy of the antibiotic when taken orally if the enzyme in the food inactives the antibiotic. FDA believes that it will be important to evaluate such concerns with respect to commercial use of antibiotic resistance marker genes in food, especially those that will be widely used. FDA is now evaluating this and other issues with respect to the use of the kanamycin resistance marker in food. (See 56 FR 20004, May 1, 1991.)

G. Plants Developed to Make Specialty Nonfood Substances

New genetic modification techniques may develop plants that produce nonfood chemicals, such as polymers and pharmaceuticals. In many cases, the plant will not subsequently be used for food. In such cases, the developer must ensure that food-use varieties of the crop do not cross with or become mixed with the nonfood-use varieties. This is not a new issue for breeders and growers. For example, some varieties of rapeseed oil are grown for industrial oil use, and have high levels of toxicants, such as erucic acid and glucosinylates, while other varieties are grown for food use and have low levels of these substances. Similarly, potatoes grown for industrial uses can have higher levels of solanine than those grown for retail food use. The producer of the oil or potato must ensure that the edible plant variety is not adulterated within the meaning of the act. Developers of crops designed to produce specialty nonfood substances have a comparable obligation.

If plants (or materials derived from plants) used to make nonfood chemicals are also intended to be used for food, producers should consult with FDA to determine whether the nonfood chemical would be a food additive requiring an authorizing regulation prior to marketing for food use.

H. Issues Specific to Animal Feeds

Unlike a food in the human diet, an animal feed derived from a single plant may constitute a significant portion of the animal diet. For instance, 50 to 75 percent of the diet of most domestic animals consists of field corn. Therefore, a change in nutrient or toxicant composition that is considered insignificant for human consumption may be a very significant change in the animal diet.

Further, animals consume plants, plant parts, and plant byproducts that are not consumed by humans. For example, animals consume whole cottonseed meal, whereas humans consume only cotton seed oil. Gossypol, a plant toxicant, is concentrated in the cotton seed meal during the production of cotton seed oil. Because plant byproducts represent an important feed source for animals, it is important to determine if significant concentrations of toxicants or other harmful plant constituents are present in new plant varieties.

Nutrient composition and availability of nutrients in feed are important safety considerations for animal health. For example, if a genetic modification in soybeans caused an increase in phytin content, the soybean feed may need to be supplemented with phosphorous to avoid problems of animal health.

V. Regulatory Status of Foods Derived From New Plant Varieties

A. The Statutory Framework for New Foods and Food Ingredients

The United States today has a food supply that is as safe as any in the world. Most foods derived from plants predate the establishment of national food laws, and the safety of these foods has been accepted based on extensive use and experience over many years (or even centuries). Foods derived from new plant varieties are not routinely subjected to scientific tests for safety, although there are exceptions. For example, potatoes are generally tested for the glycoalkaloid, solanine. The established practices that plant breeders employ in selecting and developing new varieties of plants, such as chemical analyses, taste testing, and visual analyses, rely primarily on observations of quality, wholesomeness, and agronomic characteristics. Historically, these practices have proven to be reliable for ensuring food safety. The knowledge from this past experience coupled with safe practices in plant breeding has contributed to continuous improvements in the quality, variety, nutritional value, and safety of foods derived from plants modified by a range of traditional and increasingly sophisticated techniques (Ref. 1 at xvi). Based on this record of safe development of new varieties of plants, FDA has not found it necessary to conduct, prior to marketing, routine safety reviews of whole foods derived from plants.

Nevertheless, FDA has ample authority under the act's food safety provisions to regulate and ensure the safety of foods derived from new plant varieties, including plants developed by new techniques. This includes authority to require, where necessary, a premarket safety review by FDA prior to marketing of the food. Under section 402(a)(1) of the act, a food is deemed adulterated and thus unlawful if it bears or contains an added poisonous or deleterious substance that may render the food injurious to health or a naturally occurring substance that is ordinarily injurious. Section 402(a)(1) of the act imposes a legal duty on those who introduce food into the market place, including food derived from new crop varieties, to ensure that the food satisfies the applicable safety standard. Foods that are adulterated under section 402(a)(1) of the act are subject to the full range of enforcement measures under the act, including seizure, injunction, and criminal prosecution of those who fail to meet their statutory duty.

FDA has relied almost exclusively on section 402(a)(1) of the act to ensure the safety of whole foods. Toxins that occur naturally in food and that render the food ordinarily injurious to health (such as poisons in certain mushrooms), and thus adulterated, rarely required FDA regulatory action because such cases are typically well known and carefully avoided by food producers.

FDA regards any substance that is not an inherent constituent of food or whose level in food has been increased by human intervention to be "added" within the meaning of section 402(a)(1) of the act. See *United States* v. *Anderson Seafoods, Inc.*, 622 F. 2d 157 (5th Cir. 1980). Added substances are subject to the more stringent "may render [the food] injurious" safety standard. Under this standard, the food is adulterated if, by virtue of the presence of the added substance, there is a "reasonable possibility" that consumption of the food will be injurious to health. *United States* v. *Lexington Mill & Elevator Co.*, 232 U.S. 399 (1914). The "may render injurious" standard would apply to a naturally occurring toxin in food if the level of the toxin in a new plant variety were increased through traditional plant breeding or some other human intervention. Section 402(a)(1) of the act would have been the legal basis under which FDA could have blocked marketing in the 1970's of a new variety of potato that had been found during its development to contain elevated and potentially harmful levels of solanine as a result of a cross with an inedible wild potato.

Section 402(a)(1) of the act is most frequently used by FDA to regulate the presence in food of unavoidable environmental contaminants such as lead, mercury, dioxin, and aflatoxin. FDA regulary establishes action levels and takes enforcement action to prevent the sale of foods that contain unacceptable levels of such unintended and undesired contaminants.

Section 402(a)(1) of the act was signed into law in 1938 and has its origins in a similar provision in the Federal Food and Drugs Act of 1906. Until 1958, this authority was the principal tool relied upon by FDA to regulate the safety of food and food ingredients. In 1958, in response to public concern about the increased use of chemicals in foods and food processing and with the support of the food industry, Congress enacted the Food Additives Amendment (the amendment) to the act. Among other provisions, the amendment established a premarket approval requirement for "food additives." The basic thrust of the amendment was to require that, before a new chemical additive (such as a preservative, antioxidant, emulsifier, or artificial flavor) could be used in food processing, its producer must demonstrate the safety of the additive to FDA. Congress recognized under this new scheme that the safety of an additive could not be established with absolute certainty or under all conditions of use. Congress thus provided for a science-based safety standard that requires producers of food additives to demonstrate to a reasonable certainty that no harm will result from the intended use of the additive. See 21 CFR 170.3(i). If FDA finds an additive to be safe, based ordinarily on data submitted by the producer to the agency in a food additive petition, the agency promulgates a regulation specifying the conditions under which the additive may be safely used. Food additives that are not the subject of such a regulation are deemed unsafe as a matter of law, and the foods containing them are adulterated under section 402(a)(2)(C) of the act (21 U.S.C. 342(a)(2)(C)) and are thus unlawful.

In enacting the amendment, Congress recognized that many substances intentionally added to food do not require a formal premarket review by FDA to assure their safety, either because their safety had been established by a long history of use in food or because the nature of the substance and the information generally available to scientists about the substance are such that the substance simply does not raise a safety concern worthy of premarket review by FDA. Congress thus adopted a two-step definition of "food additive." The first step broadly includes any substance the intended use of which results in its becoming a component of food. The second step, however, excludes from the definition of food additive substances that are GRAS. It is on the basis of the GRAS exception of the "food additive" definition that many ingredients derived from natural sources (such as salt, pepper, vinegar, vegetable oil, and thousands of spices and natural flavors), as well as a host of chemical additives (including some sweeteners, preservatives, and artificial flavors), are able to be lawfully marketed today without having been formally reviewed by FDA and without being the subject of a food additive regulation. The judgment of Congress was that subjecting every intentional additive to FDA premarket review was not necessary to protect public health and would impose an insurmountable burden on FDA and the food industry.

Congress' approach to defining food additives means, however, that companies developing new ingredients, new versions of established ingredients, or new processes for producing a food or food ingredient must make a judgment about whether the resulting food substance is a food additive requiring premarket approval by FDA. In many cases, the answer is obvious, such as when the ingredient is a man made chemical having no widely recognized history of safe use in food. Such an ingredient must be approved prior to its use by the issuance of a food additive regulation, based on information submitted to FDA in a food additive petition.

In other cases, the answer is less obvious, such as when an established ingredient derived from nature is modified in some minor way or produced by a new process. In such cases, the manufacturer must determine whether the resulting ingredient still falls within the scope of any existing food additive regulation applicable to the original ingredient or whether the ingredient is exempt from regulation as a food additive because it is GRAS. The GRAS status of some substances is recognized in FDA's regulations (21 CFR parts 182, 184, 186, 582, and 584), but FDA has not attempted to include all GRAS substances in its regulations.

FDA has traditionally encouraged producers of new food ingredients to consult with FDA when there is a question about an ingredient's regulatory status, and firms routinely do so, even though such consultation is not legally required. If the producer begins to market the ingredient based on the producer's independent determination that the substance is GRAS and FDA subsequently concludes the substance is not GRAS, the agency can and will take enforcement action to stop distribution of the ingredient and foods containing it on the ground that such foods are or contain an unlawful food additive.

FDA considers the existing statutory authority under sections 402(a)(1) and 409 of the act, and the practical regulatory regime that flows from it, to be fully adequate to ensure the safety of new food ingredients and foods derived from new varieties of plants, regardless of the process by which such foods and ingredients are produced. The existing tools provide this assurance because they impose a clear legal duty on producers to assure the safety of foods they offer to consumers; this legal duty is backed up by strong enforcement powers; and FDA has authority to require premarket review and approval in cases where such review is required to protect public health.

In the Federal Register of June 26, 1986 (51 FR 23302) (the June 1986 notice), FDA, in conjunction with the Office of Science and Technology Policy in the Executive Office of the President, described FDA's current food safety authorities and stated the agency's intention to regulate foods produced by

new methods, such as recombinant DNA techniques, within the existing statutory and regulatory framework. This notice reaffirms that intention. The following paragraphs explain briefly how the current framework will apply specifically to foods derived from new plant varieties, including plants developed by recombinant DNA techniques.

B. The Application of Section 402(a)(1) of the Act

Section 402(a)(1) of the act will continue to be FDA's primary legal tool for regulating the safety of whole foods, including foods derived from plants genetically modified by the new techniques. Section 402(a)(1) of the act will be applied to any substance that occurs unexpectedly in the food at a level that may be injurious to health. This includes a naturally occurring toxicant whose level is unintentionally increased by the genetic modification, as well as an unexpected toxicant that first appears in the food as a result of pleiotropic effects. Such substances are regarded by FDA as added substances whose presence adulterates the food if present at a level that "may render" the food injurious to health.

It is the responsibility of the producer of a new food to evaluate the safety of the food and assure that the safety requirement of section 402(a)(1) of the act is met. In section VII., FDA provides guidance to the industry regarding prudent, scientific approaches to evaluating the safety of foods derived from new plant varieties, including the safety of the added substances that are subject to section 402(a)(1) of the act. FDA encourages informal consultation between producers and FDA scientists to ensure that safety concerns are resolved. However, producers remain legally responsible for satisfying section 402(a)(1) of the act, and they will continue to be held accountable by FDA through application of the agency's enforcement powers.

C. The Application of Section 409 of the Act

When Congress enacted the amendment in 1958, it did not explicitly address the possible application of the food additive approval process to foods derived from new plant varieties. As previously discussed, such foods have historically been regulated successfully under section 402(a)(1) of the act. The new methods of genetic modification have focused attention, however, on the possibility that intended changes in the composition of food resulting from genetic modification might be of a nature sufficient as a legal and public health matter to trigger regulation of a component of the food under section 409 of the act.

As discussed above, the food additive definition broadly encompasses any substance that has an intended use in food, unless the substance is GRAS. It was on this basis that the June 1986 notice indicated that, in some cases, whole foods derived from new plant varieties, including plants developed by new genetic modification techniques, might fall within the scope of FDA's food additive authority. Indeed, FDA's regulations have long recognized that it might be appropriate in some circumstances to review the GRAS (and implicitly food additive) status of foods or substances of natural biological origin that have a history of safe use but which subsequently have had "significant alteration by breeding and selection." (See 21 CFR 170.30(f).) As already discussed, however, FDA has rarely had occasion to review the GRAS status of foods derived from new plant varieties because these foods have been widely recognized and accepted as safe.

FDA has reviewed its position on the applicability of the food additive definition and section 409 of the act to foods derived from new plant varieties in light of the intended changes in the composition of foods that might result from the newer techniques of genetic modification. The statutory definition of "food additive" makes clear that it is the intended or expected introduction of a substance into food that makes the substance potentially subject to food additive regulation. Thus, in the case of foods derived from new plant varieties, it is the transferred genetic material and the intended expression product or products that could be subject to food additive regulation, if such material or expression products are not GRAS.

In regulating foods and their byproducts derived from new plant varieties, FDA intends to use its food additive authority to the extent necessary to protect public health. Specifically, consistent with the statutory definition of "food additive" and the overall design of FDA's current food safety regulatory program, FDA will use section 409 of the act to require food additive petitions in cases where safety questions exist sufficient to warrant formal premarket review by FDA to ensure public health protection.

With respect to transferred genetic material (nucleic acids), generally FDA does not anticipate that transferred genetic material would itself be subject to food additive regulation. Nucleic acids are present in the cells of every living organism, including every plant and animal used for food by humans or animals, and do not raise a safety concern as a component of food. In regulatory terms, such material is presumed to be GRAS. Although the guidance provided in section VII. calls for a good understanding of the identity of the genetic material being transferred through genetic modification techniques, FDA does not expect that there will be any serious question about the GRAS status of transferred genetic material.

FDA expects that the intended expression product or products present in foods derived from new plant varieties will typically be proteins or substances produced by the action of protein enzymes, such as carbohydrates, and fats and oils. When the substance present in the food is one that is already present at generally comparable or greater levels in currently consumed foods, there is unlikely to be a safety question sufficient to call into question the presumed GRAS status of such naturally occurring substances and thus warrant formal premarket review and approval by FDA. Likewise, minor variations in molecular structure that do not affect safety would not ordinarily affect the GRAS status of the substances and, thus, would not ordinarily require regulation of the substance as a food additive.

It is possible, however, that the intended expression product in a food could be a protein, carbohydrate, fat or oil, or other substance that differs significantly in structure, function, or composition from substances found currently in food. Such substances may not be GRAS and may require regulation as a food additive. For example, if a food derived from a new plant variety contains a novel protein sweetener as a result of the genetic modification of the plant, that sweetener would likely require submission of a food additive petition and approval by FDA prior to marketing. FDA invites comments on substances, in addition to proteins, carbohydrates, and fats and oils, that in the future may be introduced into foods by genetic modification.

Section VII. of this notice provides guidance to producers of new foods for conducting safety evaluations. This guidance is intended to assist producers in evaluating the safety of the food that they market, regardless of whether the food requires premarket approval by FDA. This guidance also includes criteria and analytical steps that producers can follow in determining whether their product is a candidate for food additive regulation and whether consultation with FDA should be pursued to determine the regulatory

status of the product. Ultimately, it is the food producer who is responsible for assuring safety.

FDA has long regarded it to be a prudent practice for producers of foods using new technologies to work cooperatively with the agency to ensure that the new products are safe and comply with applicable legal requirements. It has been the general practice of the food industry to seek informal consultation and cooperation, and this practice should continue with respect to foods produced using the newer techniques of genetic modification.

VI. Labeling

FDA has received several inquiries concerning labeling requirements for foods derived from new plant varieties developed by recombinant DNA techniques. Section 403(i) of the act (21 U.S.C. 343(i)) requires that a producer of a food product describe the product by its common or usual name or in the absence thereof, an appropriately descriptive term (21 U.S.C. part 101.3) and reveal all facts that are material in light of representations made or suggested by labeling or with respect to consequences which may result from use (21 U.S.C. 343(a); 21 U.S.C. 321(n)). Thus, consumers must be informed, by appropriate labeling, if a food derived from a new plant variety differs from its traditional counterpart such that the common or usual name no longer applies to the new food, or if a safety or usage issue exists to which consumers must be alerted.

For example, if a tomato has had a peanut protein introduced into it and there is insufficient information to demonstrate that the introduced protein could not cause an allergic reaction in a susceptible population, a label declaration would be required to alert consumers who are allergic to peanuts so they could avoid that tomato, even if its basic taste and texture remained unchanged. Such information would be a material fact whose omission may make the label of the tomato misleading under section 403(a) of the act (21 U.S.C. 343(a)).

FDA has also been asked whether foods developed using techniques such as recombinant DNA techniques would be required to bear special labeling to reveal that fact to consumers. To date, FDA has not considered the methods used in the development of a new plant variety (such as hybridization, chemical or radiation-induced mutagenesis, protoplast fusion, embryo rescue, somaclonal variation, or any other method) to be material information within the meaning of section 201(n) of the act (21 U.S.C. 321(n)). As discussed above, FDA believes that the new techniques are extensions at the molecular level of traditional methods and will be used to achieve the same goals as pursued with traditional plant breeding. The agency is not aware of any information showing that foods derived by these new methods differ from other foods in any meaningful or uniform way, or that, as a class, foods developed by the new techniques present any different or greater safety concern than foods developed by traditional plant breeding. For this reason, the agency does not believe that the method of development of a new plant variety (including the use of new techniques including recombinant DNA techniques) is normally material information within the meaning of 21 U.S.C. 321(n) and would not usually be required to be disclosed in labeling for the food.

The guidance section (section VII.) of this notice discusses certain circumstances where questions may arise about the proper labeling of foods derived from new plant varieties. FDA requests comments on the labeling of foods derived from new plant varieties, including plants developed with recombinant DNA techniques.

VII. Guidance to Industry for Foods Derived From New Plant Varieties

A. Introduction

This guidance section describes many of the scientific considerations for evaluating the safety and nutritional aspects of food from new plant varieties derived by traditional methods (such as hybridization or mutagenesis), tissue culture methods (such as somaclonal variation and protoplast fusion), and recombinant DNA methods. Although some of the safety considerations are specific to individual technologies, many safety considerations are similar regardless of the technology used. This guidance section does not attempt to delineate acceptable practices for each specific technology. FDA expects plant breeders to adhere to currently accepted scientific standards of practice within each technology. This guidance section is based on existing practices followed by the traditional plant breeders to assess the safety and nutritional value of new plant varieties and is not intended to alter these long-established practices, or to create new regulatory obligations for them.

This guidance section describes food safety and nutritional concerns, rather than performance characteristics for which the new plant varieties may have been developed. However, this guidance section cannot identify all safety and nutritional questions that could arise in a given situation and, while comprehensive, should not be viewed as exhaustive. In some cases, additional factors may need to be considered, while in other situations, some of the factors may not apply. Therefore, this guidance section also describes situations in which producers should consult with FDA on scientific issues, the design of appropriate test protocols, requirements for labeling, and whether a food additive petition may be required.

Genetic modifications of plants can have unintended or unexpected effects on the phenotype of the plant, such as poor growth or reduced tolerance to conditions of environmental stress, that are readily apparent and can be effectively managed by appropriate selection procedures. However, effects such as an alteration in the concentration of important nutrients, increases in the level of natural toxicants, or the transfer of allergens from one species to another may not be readily detected without specific test procedures. FDA believes that a scientific basis should exist to establish that new plant varieties do not exhibit unacceptable effects with respect to toxicants, nutritional value, or allergens. In cases where the host plant has little or no history of safe use, the assessment of new plant varieties should include evidence that unknown toxicants are not present in the new plant variety at levels that would be injurious to health.

In addition, by using recombinant DNA techniques, plant breeders are now capable theoretically of introducing essentially any trait (and thus substance) whose molecular genetic identity is known into virtually any plant due to the increased power and precision of recombinant DNA techniques. This guidance section, however, discusses only proteins, carbohydrates, and fats and oils, in the belief that these are the principal substances that are currently being intentionally modified or introduced into new plant varieties. Using the new techniques, it is possible to introduce a gene that encodes a protein that differs significantly in structure or function, or to modify a carbohydrate, or fat or oil, such that it differs significantly in composition from such substances currently found in food. FDA believes that plant breeders must carefully evaluate the potential for adverse effects that could result from the presence of these substances in new plant varieties.

Theoretically, genetic modifications have the potential to activate cryptic

pathways synthesizing unknown or unexpected toxicants, or to increase expression from active pathways that ordinarily produce low or undetectable levels of toxicants. However, this potential has been effectively managed in the past by sound agricultural practices. The agency believes that the use of host plants with a history of safe use, coupled with a continuation of sound agricultural practice, will minimize the potential for adverse public health consequences that may arise from increased levels of unknown or unexpected toxicants.

This guidance section provides a basis for determining whether new plant varieties are as safe and nutritious as their parental varieties. The assessment scheme focuses on characteristics of the new plant variety, based on characteristics of the host and donor species, the nature of the genetic change, the identity and function of newly introduced substances, and unexpected or unintended effects that accompany the genetic change. The assessment focuses on the following considerations:

1. Toxicants known to be characteristic of the host and donor species;

2. The potential that food allergens will be transferred from one food source to another;

3. The concentration and bioavailability of important nutrients for which a food crop is ordinarily consumed;

4. The safety and nutritional value of newly introduced proteins; and

5. The identity, composition and nutritional value of modified carbohydrates, or fats and oils.

The scientific concepts described in this guidance section are consistent with the concepts of substantial equivalence of new foods discussed in a document under development by the Group of National Experts on Safety in Biotechnology of the Organization for Economic Cooperation and Development (OECD). This guidance section is also consistent with the principles for food safety assessment discussed in the Report of a Joint Food and Agriculture Organization/World Health Organization Consultation (Ref. 6).

B. Flow Charts

The flow charts presented in sections VII.D. through VII.F. (Figures 2 through 6) outline a series of questions related to the safety and nutritional value of foods derived from the new plant variety, and are intended to provide general guidance to breeders and developers. FDA intends that these flow charts be used in conjunction with other information and practices that breeders and developers rely on to develop new plant varieties. These reflect the current state of scientific information and are not intended as regulatory requirements. As new information is developed, FDA anticipates that the flow charts may require modification.

The summary flow chart (Figure 1) presented in this section is a synopsis of FDA's safety assessment process. It describes, in a general way, the assessment for unexpected or unintended effects that may arise as a result of the specific characteristics that are associated with the host plant and donor(s), as well as the assessment of the expected or intended effects. Because Figure 1 is a summary, it should not be relied upon for a safety assessment. The boxes labeled Figure 2, Figure 3, Figure 4, and Figures 5 and 6, respectively, refer to more specific flow charts that describe, in appropriate detail, the safety assessment from the perspective of the host, donor, and new substances that are introduced into the new plant variety.

Sections VII.D. through VII.F. address the scientific considerations pertaining to the host plant, donor(s), and new substances in more detail. Each section describes information that relates to the safety assessment, presents a flow chart that summarizes the safety assessment, discusses each of the questions in that flow chart, and describes the endpoints that are reached in that flow chart.

There are three endpoints in the flow charts in this notice: (1) No concerns, (2) new variety not acceptable, and (3) consult FDA. The notes to each individual flow chart discuss the interpretation of these endpoints in relation to that particular flow chart. In general, the interpretation of "no concerns" or "new variety not acceptable" is similar for each flow chart. The endpoint "consult FDA" means that producers may need to consult FDA on regulatory questions, such as whether a food additive petition or special labeling is needed, or on technical questions, such as appropriate testing protocols or specific scientific issues.

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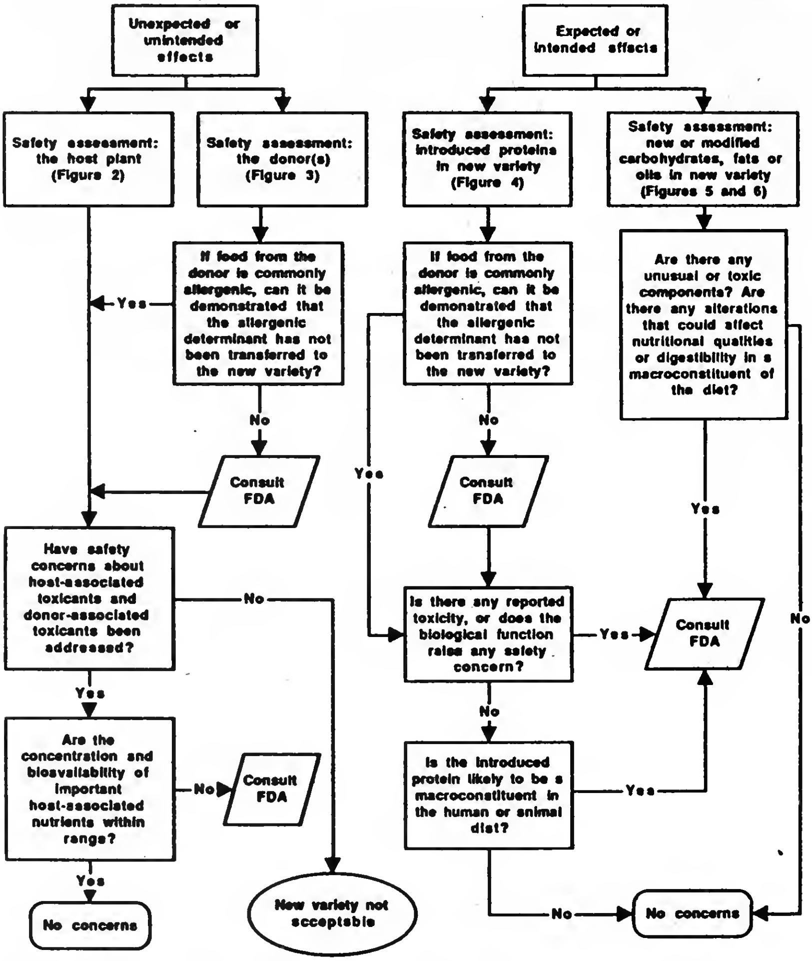

Figure 1. Safety Assessment of New Varieties: Summary

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C. Effects of Processing

Processing (e.g., cooking) may affect the safety of a substance. This is particularly important in the safety assessment of proteins transferred from one food source to another. For example, lectins, which are inactivated by cooking, would raise a safety concern if transferred from kidney beans, which are eaten cooked, to tomatoes, which may be eaten raw. The effects of any potential differences in food processing between the donor and the new plant variety should be carefully considered at each stage in the safety assessment.

D. The Host Plant

A premise basic to this guidance section is that a long history of safe use of the host species in food provides much information regarding the potential of new plant varieties to produce toxicants and antinutrients (substances that adversely affect the nutritional quality of food). In assessing the potential of the host plant to contribute unexpected harmful substances, producers should consider attributes of the host plant and its progenitors such as the following:

1. Taxonomy.

a. Variety name.

b. Known phenotypes and relevant genotypes.

2. Other species or varieties that have previously contributed genetic information to the host.

3. History of safe use.

a. Extent of previous experience.

b. The part of the plant used as food.

c. The presence and identity of potentially harmful constituents such as toxicants and antinutrients.

d. Typical methods of processing and the impact of this processing on the reduction or enhancement of effects from potentially harmful constituents.

4. The identity and level of nutrients for which the food is consumed

Figure 2

The numbers above each box in the flow chart refer to accompanying notes that immediately follow the flow chart.

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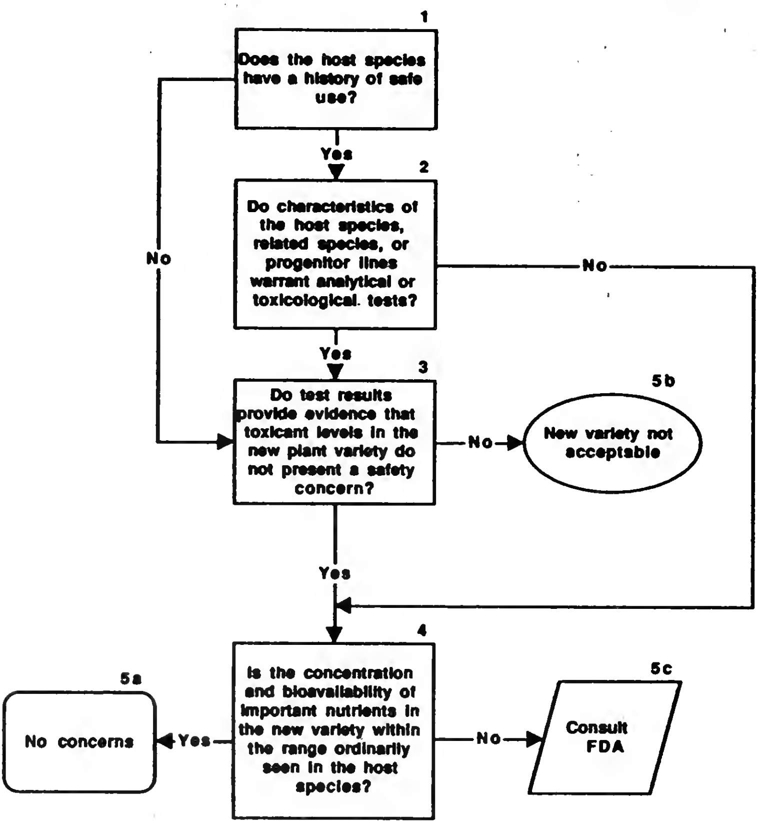

Figure 2. Safety Assessment of New Varieties: The Host Plant

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Notes to Figure 2

1—Does the host species have a history of safe use?

This guidance section is primarily designed for the development of new varieties of currently consumed food plants whose safety has been established by a history of use. If exotic species are used as hosts, testing may be needed to assure the safety and wholesomeness of the food.

2—Do characteristics of the host species, related species, or progenitor lines warrant analytical or toxicological tests?

It is not possible to establish a complete list of all toxicants that should be considered for each plant species. In general, the toxicants that are of highest concern in any particular species are those that have been documented to cause harm in normal or animal diets, or that have been found at unsafe levels in some lines or varieties of that species or related species.

In many cases, characteristic properties (such as a bitter taste associated with alkaloids) are known to accompany elevated levels of specific natural toxicants. If such characteristic provide an assurance that these toxicants have not been elevated to unsafe levels, analytical or toxicological tests may not be necessary.

3—Do test results provide evidence that toxicant levels in the new plant variety do not present a safety concern?

If a host plant or related species is known to contain toxicants whose presence must be assessed, analytical tests may be appropriate to establish that the toxicant levels are in a safe range. There is, however, a wide variation in the level of natural toxicants within and between varieties of a species, due to differences in genetic makeup and in environmental conditions during growth, harvest, and storage. Due to this natural variation, analytical tests, if necessary, should be performed using as a control the parental variety that has been grown, harvested, and stored under the same conditions as the new plant variety.

In some cases, analytical methods alone may not be available, practical, or sufficient for all toxicants whose levels are needed to be assessed. In such situations, comparative toxicological tests on the new and parental plant varieties may provide assurance that the new variety is safe. FDA encourages producers of new plant varieties to consult informally with the agency on testing protocols for whole foods when appropriate.

4—Is the concentration and bioavailability of important nutrients in the new variety within the range ordinarily seen in the host species?

If the native levels of important nutrients for which a food is widely consumed are not within the range ordinarily seen in the host species, appropriate labeling may be required. In addition, changes in bioavailability of a nutrient due to changes in form of the nutrient or the presence of increased levels of other constitutents that affect absorption or metabolism of nutrients must be considered for potential nutritional impact.

5—Endpoints in Figure 2.

5a—No concerns.

When this endpoint is reached, safety and nutritional concerns relative to the host plant will generally have been satisfied.

5b—New variety not acceptable.

This endpoint is reached when test results indicate that food derived from the new plant variety may be unsafe—e.g., if it contains unacceptable levels of toxicants.

5c—Consult FDA.

Producers should consult informally with FDA when the concentration or bioavailability of important nutrients is not within the range ordinarily seen in the host species. FDA will work with the producers on a case-by-case basis to address requirements such as labeling, or other issues relating to nutritional concerns.

E. The Donor(s)

In some cases, the donor will not have a history of safe use in food. For example, the donor may be a wild species that is related to the host plant, or may be a microorganism with no history of use in food. The potential of the donor(s) to contribute undesirable characteristics to the new plant variety should be assessed. In assessing the potential of the donor to contribute unexpected harmful substances, producers should consider attributes of the donor plant, or of fragments of genetic material from one or multiple donors, to the extent that such information is available (see Figure 3).

1. Donor Plants

Attributes of the donor plant and its progenitors, such as the following, should be considered:

1. Taxonomy.

a. Variety name.

b. Known phenotypes and relevant genotypes.

2. Other species or varieties that have previously contributed genetic information to the donor plant.

3. History of use (as applicable).

a. The part of the plant used as food.

b. The presence and identity of potentially harmful constituents such as toxicants, antinutrients, and allergens.

c. Typical methods of processing and the impact of this processing on the reduction or enhancement of effects from potentially harmful constituents.

2. Fragments of Donor Genetic Material

Attributes of each donor, and its progenitors when appropriate, such as the following, should be considered:

1. Taxonomy.

2. Other species or varieties that have previously contributed genetic information to the donor(s).

3. History of use (as applicable).

a. The part of the donor(s) used as food.

b. The presence and identity of potentially harmful constituents, such as toxicants, antinutrients, and allergens.

c. Typical methods of processing and the impact of this processing on the reduction or enhancement of effects from potentially harmful constituents.

d. The association of the transferred genetic material with harmful constituents.

4. Additional information consistent with currently accepted scientific practices, such as:

a. History and derivation of molecular constructs, such as passage through microbial hosts.

b. Known activities of any introduced regulatory sequences, such as environmental, developmental and tissue-specific effects on promoter activity.

c. The presence of extraneous open reading frames, and the potential for transcription and expression of these additional open reading frames.

Figure 3

The numbers above each box in the flow chart refer to accompanying notes that immediately follow the flow chart.

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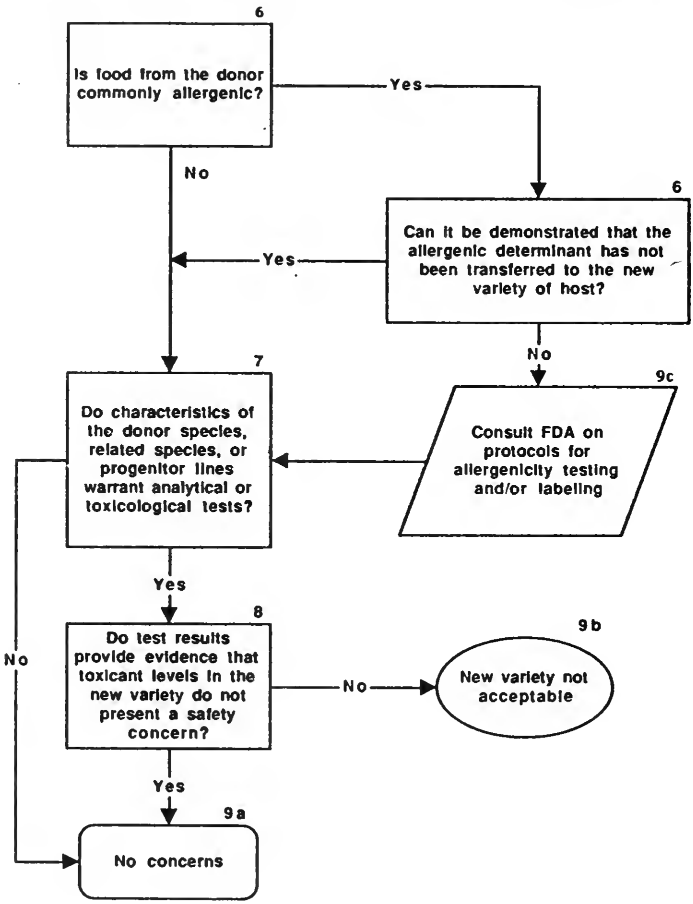

Figure 3. Safety Assessment of New Varieties: The Donor(s)

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Notes to Figure 3

6—Is food from the donor commonly allergenic? If yes, can it be demonstrated that the allergenic determinant has not been transferred to the new variety of host plant?

Some examples of foods that commonly cause an allergenic response are milk, eggs, fish, crustacea, molluscs, tree nuts, wheat, and legumes (particularly peanuts and soybeans). Allergens from these common sources may be knowingly or unknowingly transferred from a donor to a new variety of host plant. Knowledge of the identity of the allergenic determinant of the donor, coupled with appropriate knowledge of the genetic fragment that has been transferred from the donor to the new plant variety, may provide sufficient evidence that the allergenic determinant has not been transferred to the new variety of the host plant.

7—Do characteristics of the donor species, related species, or progenitor lines warrant analytical or toxicological tests?

It is possible that a toxicant present in the donor may be transferred to the host, e.g., during hybridization of a cultivated variety with a wild, poisonous relative. However, it is also possible to use a toxic donor safely. For example, a gene coding for an enzyme that is not toxic and does not yield toxic products may be isolated from pathogenic bacteria and safely transferred to a plant.

The potential that toxicants known to exist in the donor, related species, or progenitor lines will be present in the new plant variety should be addressed as described previously for the host plant (section VII.D.). Unless there is sufficient evidence that the toxicant has not been transferred to the new variety of host plant, such transfer should be assumed, and analytical and/or toxicological tests may be warranted.

8—Do test results provide evidence that toxicant levels in the new variety do not present a safety concern?

When the presence of donor-associated toxicants must be assessed, analytical or toxicological studies may provide assurance that the new variety is safe as described previously for the host species (section VII.D.). FDA encourages producers of new plant varieties to consult with the agency on testing protocols.

9—Endpoints in Figure 3.

9a—No concerns.

When this endpoint is reached, safety concerns relative to the donor will generally have been satisfied.

9b—New variety not acceptable.

This endpoint is reached when test results indicate that food derived from the new plant variety may be unsafe, e.g., if it contains unacceptable levels of toxicants.

9c—Consult FDA.

Appropriately designed tests may provide evidence that the suspected allergen in the donor was not transferred to the new plant variety, or is not allergenic in the new variety. Producers should consult informally with FDA on protocols that are designed to assess allergenicity. FDA will work with the producer on a case-by-case basis to address requirements such as labeling.

F. Substances Introduced Into the Host Plant From the Donor(s)

Safety assessment should address the specific risks associated with the new substances introduced from the donor(s) to a degree that is consistent with currently accepted scientific practices.

1. Proteins

Depending upon the circumstances, safety assessment of an introduced protein should be based on:

1. Presence and level in the food product.
2. Origin.
3. Known or suspected allergenicity.
4. Evidence of consumption in other foods at similar levels and under similar conditions of processing (e.g., eaten cooked or uncooked).
5. Effects of processing (e.g., cooking).
6. Biological function.
7. Known or potential toxicity.
8. Chemical differences and similarities to edible proteins.
9. The presence of host-specific posttranslational modifications.

Figure 4

The numbers above each box in the flow chart refer to accompanying notes that immediately follow the flow chart.

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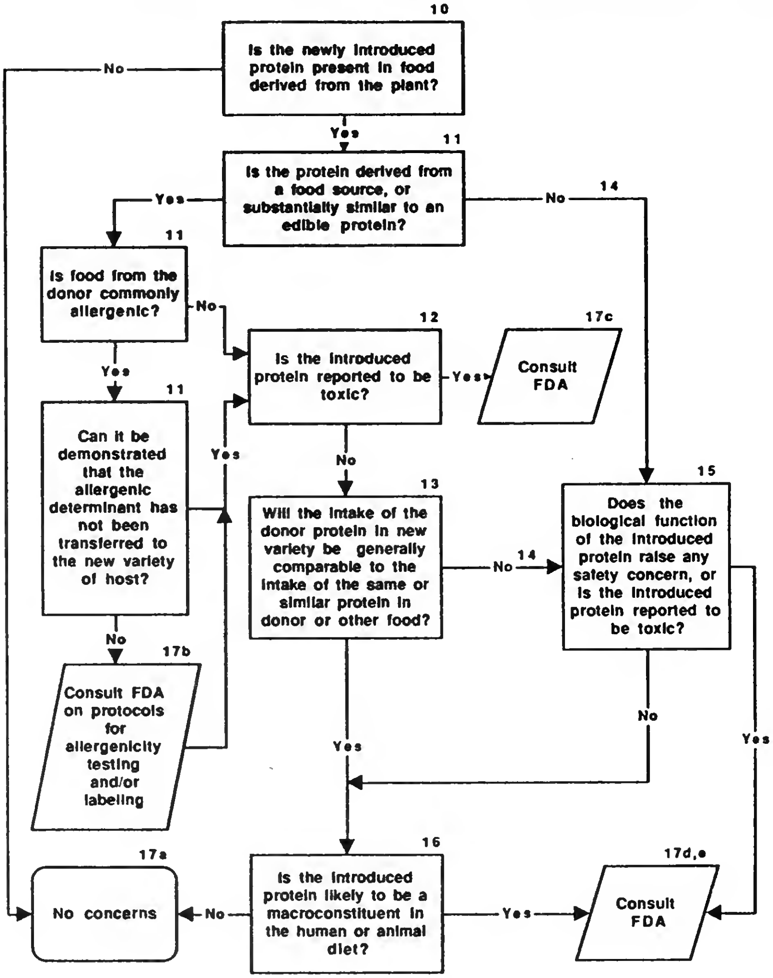

Figure 4. Safety Assessment of New Varieties: Proteins Introduced from Donor(s)

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Notes to Figure 4

10—Is the newly introduced protein present in food derived from the plant?

For example, an enzyme introduced to alter the fatty acid composition of an oil may be removed from the oil as a result of processing. Alternatively, an enzyme introduced to confer antibiotic resistance for use as a selectable marker may be present in food products.

11—If an introduced protein is derived from a food source, the question of allergenicity must be addressed in the same fashion as was discussed from the perspective of the donor as a whole.

12—Is the introduced protein that is derived from a food source, or is substantially similar to an edible protein, reported to be toxic?

For example, some lectins are toxic unless inactivated by cooking. If a protein whose safety is dependant on processing such as cooking has been transferred from a species that is commonly cooked before consumption to a species that may be eaten raw, safety questions may arise.

13—If the intake of an introduced protein that is derived from a food source, or that is substantially similar to an edible protein, is not generally comparable to the intake of the same or similar protein in the donor or other food, the biological function of the protein should be assessed.

14—The biological function of the introduced protein should be assessed if either of the following occur:

a. The introduced protein is not derived from a food source, or is not substantially similar to an edible protein; [6]

b. The intake of the introduced protein in the new variety is not comparable to the intake of the same or similar protein in the donor or other food.

15—Does the biological function of the introduced protein raise any safety concerns, or is the introduced protein reported to be toxic?

In general, proteins that function as enzymes do not raise concern [7] Exceptions include enzymes that produce substances that are not ordinarily digested and metabolized by vertebrates, or that produce toxic substances (e.g., the enzymes that convert cyanogenic glycosides to cyanide).

Other functions that could raise concern include any reported toxicity, such as known toxic activity toward vertebrates, known toxic activity toward nonvertebrates when the absence of toxic activity to vertebrates is not established, and unusual properties that indicate that the protein is significantly different from other proteins found in the diet. If the function of the protein is not known, see note 17d.

16—Is the introduced protein likely to be a macroconstituent in the human or animal diet?

From a nutritional standpoint, the amount and quality of total protein in the diet, rather than of any particular protein, is of greatest significance. However, while most individual proteins (e.g., enzymes) that might be introduced into food derived from plants will be present at relatively low concentrations, some proteins (e.g., seed storage proteins) [8] may become macroconstituents of the plant-derived food. Other proteins (e.g., enzymes used as selectable marker genes) may be introduced into many plants and therefore be consumed at a substantial level. Dietary exposure to such proteins should be considered.

17—Endpoints in Figure 4.

17a—No concerns.

When this endpoint is reached, safety concerns relative to intentionally introduced proteins will generally have been satisfied.

17b—Consult FDA: Allergens.

Producers should consult informally with FDA on protocols that are designed to assess allergenicity. FDA will work with the producer on a case-by-case basis to address requirements such as labeling.

17c—Consult FDA: Toxicity.

Producers should consult informally with FDA when a protein is reported to be toxic or when the safety of an introduced protein is dependent on processing such as cooking. FDA will determine on a case-by-case basis whether it will review the food additive status of these proteins, or whether the proteins are unacceptable in the new plant variety.

17d—Consult FDA: Function and toxicity.

Producers should consult informally with FDA on scientific issues and design of appropriate test protocols when the function of the protein raises concern or is not known, or the protein is reported to be toxic. FDA will determine on a case-by-case basis whether it will review the food additive status of these proteins.

17e—Consult FDA: Macroconstituents in the diet.

Producers should consult informally with FDA when a protein is expected to become a macroconstituent of the diet, whether as a result of its presence in high levels in one food or as a result of its use in many foods. FDA will determine on a case-by-case basis whether it will review the food additive status of these proteins.

2. Carbohydrates

Safety assessment of a new or modified carbohydrate should be based on the nature of the carbohydrate or modification.

Figure 5

The numbers above each box in the flow chart refer to accompanying notes that immediately follow the flow chart.

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[6] The issue of potential allergenicity of any new protein (as opposed to the allergenicity of a protein derived from a known source of allergens) is frequently raised. FDA recognizes that routine procedures for testing foods derived from new plant varieties for the presence of unknown allergens are not currently available. If the donor has no history of use in food, the issue of allergenicity cannot be addressed at this time. Comparison of gene sequences to data banks of known allergens may become increasingly useful as the information on such proteins expands. FDA invites comments on methods that may be available to address the issue of allergenicity of new proteins in foods.

[7] Pariza and Foster (Ref. 7) note that very few toxic agents have enzymatic properties. Exceptions include diphtheria toxin and certain enzymes in the venom of poisonous snakes.

[8] The nutritional content of seed storage proteins from some crops is particularly important in the case of animal feed, where one crop may furnish a substantial portion of the diet.

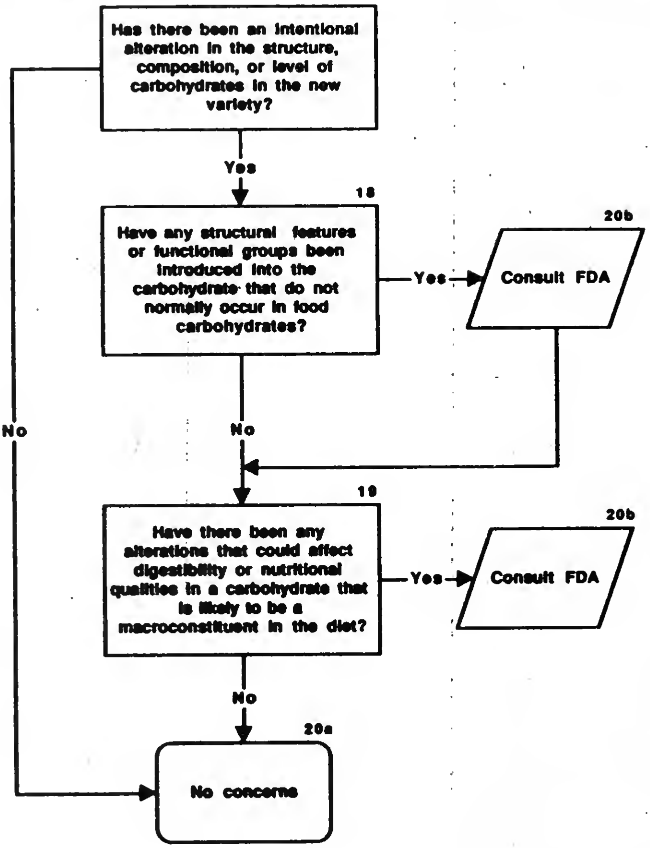

Figure 5. Safety Assessment of New Varieties: New or Modified Carbohydrates

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Notes to Figure 5

18—Have any structural features or functional groups been introduced into the carbohydrate that do not normally occur in food carbohydrates?

For example, developments that affect carbohydrates will frequently be modifications of food starches, presumably affecting the content of amylose and amylopectin, as well as the branching of amylopectin. Such modified starches are likely to be functionally and physiologically equivalent to starches commonly found in food and thus would not suggest any specific safety concerns. However, if functional groups or structural features that normally do not occur in food carbohydrates are introduced, such modifications should be evaluated with respect to any safety concerns that may arise.

19—Have there been any alterations that could affect digestibility or nutritional qualities in a carbohydrate that is likely to be a macroconstituent in the diet?

If a vegetable or a fruit is modified to produce high levels of an indigestible carbohydrate that normally occurs at very low levels, or to convert a normally digestible carbohydrate to an indigestible form, nutritional questions may arise.

20—Endpoints in Figure 5.

20a—No concerns.

When this endpoint is reached, safety and nutritional concerns relative to intentional modifications of food carbohydrates will generally have been satisfied.

20b—Consult FDA.

Producers may consult informally with FDA on scientific issues. FDA will determine on a case-by-case basis whether it will review the food additive status of these carbohydrates, and will work with the sponsor on a case-by-case basis to address requirements such as labeling.

3. Fats and Oils

Safety assessment of a new or modified fat or oil should be based on its composition and the presence of any unusual components at levels that would cause safety concern.

Figure 6

The numbers above each box in the flow chart refer to accompanying notes that immediately follow the flow chart.

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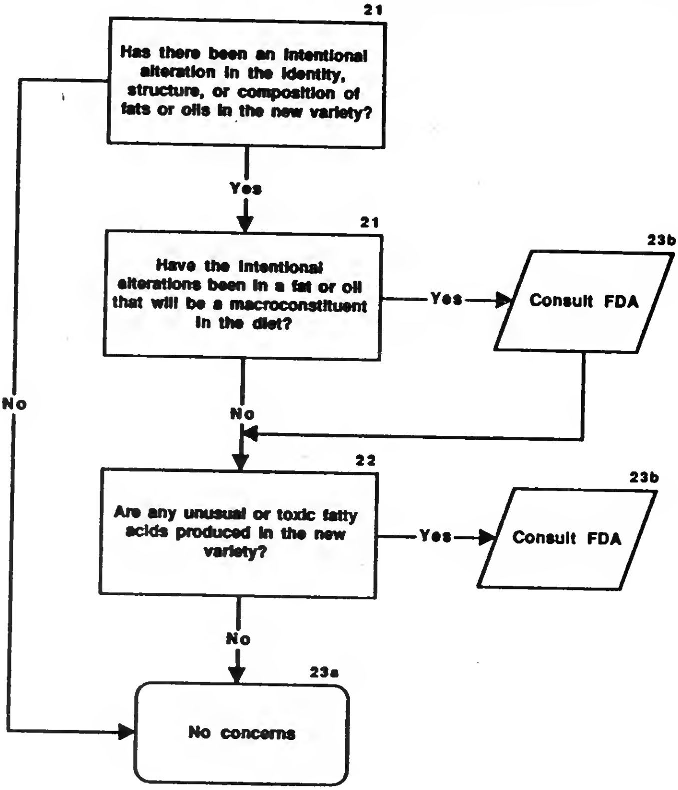

Figure 6. Safety Assessment of New Varieties: New or Modified Fats or Oils

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Notes to Figure 6

21—Has there been an intentional alteration in the identity, structure, or composition of fats or oils that are likely to be a macroconstituent in the diet?

Some alterations in the composition or structure of fats and oils, such as an alteration in the ratio of saturated to unsaturated fatty acids, may have significant nutritional consequences, or result in marked changes in digestibility. Other changes may produce a fat or oil that has been altered such that it is no longer representative of fats and oils from the host species.

22—Are any unusual or toxic fatty acids produced in the new variety?

For example, safety questions may arise as a result of the presence of fatty acids with chain length greater than C-22, fatty acids with cyclic substituents, fatty acids with functional groups not normally present in dietary fats and oils, and fatty acids of known toxicity (e.g., erucic acid).

23—Endpoints in Figure 6.

23a—No concerns.

When this endpoint is reached, safety and nutritional concerns relative to intentional modifications of fats and oils will generally have been satisfied.

23b—Consult FDA.

Producers may consult informally with FDA on scientific issues. FDA will determine on a case-by-case basis whether it will review the food additive status of these fats or oils, and will work with the sponsor on a case-by-case basis to address requirements such as labeling.

G. Toxicology

Feeding studies or other toxicological tests may be warranted when the characteristics of the plant or the nature of the modification raise safety concerns that cannot be resolved by analytical methods. FDA recognizes that feeding studies on whole foods have limited sensitivity because of the inability to administer exaggerated doses. Because of the difficulty of designing meaningful studies, FDA encourages companies to consult informally with the agency about test protocols.

H. Other Information

The information described below is not directly addressed in the flow charts but should be considered during the development of new plant varieties.

1. Nucleic Acids

Introduced nucleic acids, in and of themselves, do not raise safety concerns. Thus, for example, the introduction of a gene encoding an anti-sense ribonucleic acid (RNA) would not raise concerns about either the gene or the anti-sense RNA. Any safety considerations would focus on the intended effects of the anti-sense RNA. Hence, continuing the example, if the anti-sense RNA were used to suppress an enzyme, then just as for any other method intended to suppress an enzyme, such as deletion or nonsense mutations, the metabolic effects on the host plant of such enzyme suppression should be considered at the conceptual stage of development and monitored, when appropriate and feasible.

2. Metabolic Considerations

The effects of an intentional alteration of a biochemical pathway should be considered at the conceptual stage of development, and monitored when appropriate and feasible. For example, are there any toxic effects of a metabolic imbalance with respect to enzyme substrate depletion and product accumulation? Are any auxiliary pathways likely to be affected?

3. Stability

The genetic stability of the new plant variety and the inheritance of the introduced genetic material as a single Mendelian trait are important safety considerations. A safety assessment of food derived from early generations of the new variety may not be valid if the new genetic material is expressed at substantially different levels in subsequent generations. Factors that favor stability include a minimum number of copies of the introduced genetic material, and insertion at a single site.

I. Future Workshop on Scientific Issues

FDA recognizes the desirability of establishing consensus within the industry, the scientific community, and the public on the agency's scientific assessment approach to food safety presented in this guidance section. For this reason, FDA plans to announce, in a future **Federal Register** notice, a workshop to discuss specific scientific issues. The notice announcing the workshop will include a description of the scientific issues to be discussed. FDA invites comment on topics that might be addressed at such a workshop.

VIII. Environmental Consideration: Applicability of NEPA

NEPA requires FDA to consider in its decisionmaking the environmental impact of its major Federal actions that significantly effect the quality of the human environment. The promulgation of a food additive regulation is an agency action that ordinarily triggers the NEPA requirement for development of an environmental assessment (21 CFR 25.22(a)(10)) and, if the agency does not make a finding of no significant environmental impact, an environmental impact statement is prepared (21 CFR 25.21(b)).

The Council on Environmental Quality (CEQ) regulations (40 CFR 1500 through 1508) provide that in complying with NEPA, an agency should avoid unnecessary duplication and should tier its NEPA statements with those of other agencies to eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision at each level of environmental review (40 CFR 1502.20 and 1508.28).

Other agencies, particularly USDA and EPA, may prepare NEPA and other environmental documentation before products are presented to FDA for a decision. FDA intends to rely on such documentation to the maximum extent possible.

Under regulations administered by the Animal and Plant Health Inspection Service (APHIS) in USDA (7 CFR part 340), the majority of plants developed by recombinant DNA techniques that are being commercially developed have been considered "regulated articles." The action that results in a permit for introduction of a regulated article into the environment is subject to NEPA review. At some stage of research and development of a regulated article, an interested party will request from APHIS a determination of the article's regulatory status. APHIS has informed FDA that when APHIS receives a petition or other request it intends to consult with other agencies. This should enable FDA to identify the type of data that would be useful if any subsequent environmental review is to be prepared for actions under FDA jurisdiction.

EPA has authority, under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 U.S.C. 136 *et seq.*), to regulate all pesticides, no matter how they are made or their mode of action. Under the act, EPA has authority to regulate pesticide residues in foods. Any relevant review that EPA conducts under FIFRA, the act, or any other of its statutes, involving an assessment of potential effects on human health and the environment will be available to FDA.

FDA intends to work closely with USDA and EPA to minimize duplication of environmental reviews. The agency will, to the extent possible, invoke the tiering provisions in the CEQ regulations and, in FDA's environmental assessments, rely on APHIS NEPA reviews and other such documents, as well as relevant environmental documents considered by EPA. Further,

FDA will provide informal guidance on environmental issues to assist individuals who are preparing food additive petitions to meet FDA's requirements for environmental assessments.

FDA does not consider that the activities it may undertake with respect to foods from new plant varieties other than promulgation of food additive regulations, such as consultation with producers on safety issues and providing advice on the regulatory status of foods from new plant varieties, will constitute agency action under NEPA.

IX. Coordination With EPA: Pesticide Considerations

Questions have been raised concerning whether FDA or EPA would have jurisdiction when plants are modified to express pesticidal substances. FDA and EPA are agreed that substances that are pesticides as defined by FIFRA (7 U.S.C. section 136(u)), are subject to EPA's regulatory authority. The agencies also agree that FDA's authority under the act extends to any nonpesticide substance that may be introduced into a new plant variety and that is expected to become a component of food.

EPA and FDA are aware that there may be cases in which the jurisdictional responsibility for a substance is not clear. Because pesticides, as defined by FIFRA, are subject to EPA's jurisdiction, the agencies encourage producers who have such questions to contact EPA. FDA and EPA intend to consult closely on such jurisdictional questions, as well as on scientific matters where consultation will be helpful in resolving safety questions.

The agencies are also aware that, in some circumstances, evaluation of a particular substance introduced into a plant may require the expertise of both EPA and FDA. Both agencies agree that EPA will address under its regulatory jurisdiction the food safety issues associated with the pesticide, including marker genes used to confirm the presence of the pesticidal gene. Any food safety questions beyond those associated with the pesticide, such as those raised by unexpected or unintended compositional changes, are under FDA's jurisdiction and should be addressed under the policy set forth elsewhere in this notice.

Based upon the agencies' current knowledge, examples of substances that fall under FDA's authority include: (1) Substances intended to alter the nutritional composition of the food (e.g., amino acids or carbohydrates); (2) substances intended to enhance the plant's resistance to chemical herbicides (e.g., bromoxynil, glyphosate, and sulfonylurea); and (3) substances intended to alter the flavor or the texture of the food.

Similarly, based upon the agencies' current knowledge of new plant varieties being developed using the new technologies of gene transfer, EPA is in the process of evaluating how or if it will exert its oversight for the following examples subject to its jurisdiction under FIFRA and therefore not under FDA's jurisdiction: (1) Substances that are intended to kill insects (e.g., *Bacillus thuringiensis* delta-endotoxin);

(2) Substances intended to protect plants from viral, fungal, or bacterial infection (e.g., cecropin); and (3) substances that are plant regulators and thus "pesticides" under FIFRA.

X. Environmental Impact

The agency has determined under 21 CFR 25.24(a)(8) that this action is of a type that does not individually or cumulatively have a significant effect on the human environment. Therefore, neither an environmental assessment nor an environmental impact statement is required.

This action is intended to provide guidance to developers by describing the scientific considerations for the safe development of foods derived from new plant varieties.

XI. Comments

Interested persons may, on or before August 27, 1992, submit to the Dockets Management Branch (address above) written comments regarding this notice. Two copies of any comments are to be submitted, except that individuals may submit one copy. Comments are to be identified with the docket number found in brackets in the heading of this document. Received comments may be seen in the office above between 9 a.m. and 4 p.m., Monday through Friday.

XII. References

The following references have been placed on display in the Dockets Management Branch (address above) and may be seen by interested persons between 9 a.m. and 4 p.m., Monday through Friday.

1. Anonymous, "Biotechnologies and Food: Assuring the Safety of Foods Produced by Genetic Modification," International Food Biotechnology Council, Regulatory Toxicology and Pharmacology, Vol. 12, No. 3, Part 2 of 2 Parts, New York, December 1990.

2. Letter, Hopkins, D. D., R. J. Goldburg, and S. A. Hirsch to Dr. David Kessler, September 30, 1991, and enclosure, "A Mutable Feast: Assuring Food Safety in the Era of Genetic Engineering."

3. Letter, Richard D. Godown to James H. Maryanski, January 3, 1992; Letter, W. Douglas Crabb to Fred R. Shank, January 24, 1992.

4. Comments to Docket No. 90A-0416, **Federal Register**, May 1, 1991 (56 FR 20004).

5. Dale, E. C. and D. W. Ow, "Gene Transfer with Subsequent Removal of the Selection Gene from the Host Genome," Proceedings of the National Academy of Sciences USA, 88:10558–10562, 1991.

6. Anonymous, "Strategies for Assessing the Safety of Foods Produced by Biotechnology," World Health Organization, Geneva, 1991.

7. Pariza, M. W. and E. M. Foster, "Determining the Safety of Enzymes Used in Food Processing," Journal of Food Protection, 46:453–468, 1983.

Dated: April 2, 1992.

David A. Kessler,

Commissioner of Food and Drugs.

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WITNESSES

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